THE

# ELECTRICAL REVIEW.

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## RAPID TRANSIT IN CITIES.

THIS problem has, to a large extent, been solved in America by mechanical railways, which include cable, compressed air, steam, and electric systems. There is in the States less trouble in overcoming the few difficulties in the way of introducing mechanical traction than in the older cities of Britain and other European countries.

That electric traction is rapidly superseding all the other systems in city and suburban transit in America is gratifying to the electrical engineer, at the same time we must not blind ourselves to the difficulties in the way of its introduction nearer home. No one can gainsay but that, financially speaking, electric locomotion is superior to horse traction where overhead trolley wires are permissible, and in spite of the acknowledged inefficiency of this system, it is yet more profitable than horse or cable methods. The objection to it is the overhead trolley wires; these require to be suspended over the streets on substantial poles with long cross arms, and it is at once obvious that in the very places where rapid transit is most necessary, and where horse traction is most objectionable, such an overhead construction with poles on the streets is altogether impossible, for in the crooked, narrow thoroughfares in the older parts of cities, we generally find the greatest congestion of traffic, and no mechanical system of traction on the surface can ever hope to provide rapid transit in such places.

The only systems of rapid transit offering a relief for the congestion in these parts, are either underground or elevated street railways, and in either of these electric traction would undoubtedly be now adopted in preference to steam or any other power.

In provincial and suburban lines, there can be no reason why the trolley system with overhead wires should not be employed with ordinary street railways.

The difficulty is not with the motive power to move the train or car; in cities the trouble is with the road, and with the general traffic. It is quite easy to provide electric vehicles to run either on rails or without them, but neither of them would effectually solve the problem. Even apart from the objections to the open slot in the street for a conduit connection, or to the trolley overhead wire, the rails themselves are exceedingly troublesome in narrow crowded thoroughfares, and add considerably to the expense of the maintenance of the roads; on the other hand there is a positive advantage in confining mechanically driven vehicles to a track, for it renders them much safer than they otherwise would be. Their line of motion is known, and they cannot deviate with the whim or caprice of the driver, and all other drivers can keep clear of the line, but if mechanically-driven vehicles were allowed to run on the streets unconfined to any track, the danger would be very greatly increased; one would never know which way

they might swerve at any moment, and they could not be stopped very quickly. Horses in cities manage their own movements intelligently, as a rule, and the pedestrian and the drivers instinctively know the course to take among horse driven vehicles; but very few people could move safely and easily among them if mechanically propelled and free to run all over the streets. While the rails are objectionable on the roads, they are yet a necessity where mechanical traction is resorted to.

On these grounds we do not believe the present movement in Paris towards the discovery of a mechanically driven carriage, adaptable for street traffic, will meet with more than transient success. In that city no less than 46 competitive vehicles have entered into a contest for prizes ranging from 5,000 to 500 francs, offered for the best road carriage suitable for streets in cities. They have been tested on short runs in Paris, and on Sunday a test was made on a long trip of 68 miles to Rouen. What the results are has not yet transpired.

Carriages running on streets without rails must contain a store of energy of some kind; electric, gas, or compressed air, or carry a steam boiler, coals, water, and engines. All these have been thoroughly tried before, and none of them are practicable except on rails. The enormous weight of the machinery and storage on free running vehicles is prohibitive; nothing but the iron way can stand the weight on mechanically driven carriages.

From every point of view rails are seen to be necessary, first to keep the vehicles to a definite track, to save power in propulsion, and to carry the weight of the vehicles, so that even if our Parisian neighbours discover a good mechanically driven carriage, they will have gone but one step in the direction of rapid transit in streets.

The important question is whether rails are permissible or not. If rails are not forbidden the problem of rapid transit is comparatively easy; but if no rails are allowed, then we have no hesitation in saying that no mechanically driven vehicle has yet been devised to meet the case.

In London, electrically worked underground railways would relieve the necessities of the case to a large extent, but no system of surface railways could be tolerated among the other traffic in such streets as we have in this city.

## A POINT IN ALTERNATING CURRENT DISTRIBUTION.

The "Battle of the Systems" was a feature of electric lighting of a few years ago, a period when such lighting was principally a matter of abstruse calculation on paper; although much talked about, the light was seldom seen. The next stage was the reduction of mathematical particularisations to general practice, this being accomplished at last by discarding many of the niceties which had received such careful attention at the meetings of the then Society of Telegraph Engineers. Gradually it dawned upon the leading lights of the profession that it would be very much wiser to follow practice, and argue from the peculiarities observed in the actual supply of electrical energy, as to the causes of complex losses and efficiencies—we rather ought to say inefficiences—than to predict beforehand what would result from given combinations. This course had the merit of being a prudent one on the part of those whose ambition it was to figure as scientific prophets. If they found that what they had hoped would come to pass did actually occur, then it was very easy to hunt up a musty paper read before some exclusive and learned society, and to show that within its mathematical flights of genius lay the truth which, in a common everyday manner, had been corroborated by practice.

If an event took place which was unforeseen, and the central station engineer was at his wit's end for an explanation, there usually arose a prophet who showed that the whole thing was simple enough; it was but a corollary of some expression contained in a classical paper, which very likely dealt with a totally different subject—but there it was. Unfortunate for the "common man," the classical explanation was often so far above his head, that even when it was explained to him, he failed to perceive that the reason for what he had observed, and been nonplussed by, lay within his grasp, and that if he would but reach out and accept it, it provided a way out of his difficulties, in addition to showing him what they were, and why they troubled him. So dense, however, was he, that though he could run a station, make it pay, and give satisfaction to his directors and to the public by the supply afforded them, he had to get someone to give him an explanation—very likely far from classical—which he could understand and use as a tool to make his wrongs right.

But as "it is not safe to prophesy unless you know," the professors found the classical method of explaining practical incidents a most useful one; it enabled them to know what they were about to prophesy, and so avoid the chance of coming to grief. Something very similar to all this happened in connection with some of the first attempts to lay cables for alternating current distribution underground. Perhaps it was foreseen by some—certainly it was not by the majority—that if rubber-covered cables were to be run in metallic conduits, it was imperative that either the lead and return conductors should be placed together in one duct, or that they should be concentric, which was even better. Attention was drawn to the inductive drop where this rule was not followed by a case in Cheapside—pointed out, if we remember aright, by Mr. Mordey—where the two conductors were laid in separate wrought-iron pipes, resulting in a drop of something like 17 volts in a few yards of service line. The trouble having been located, its cause was easily understood and a remedy at once applied. The two cables had only to be run in one pipe and the loss disappeared.

The fact that trouble has in the past resulted from the combination of alternating currents, two conductors and iron pipes seems to have been remembered by at least one gentleman, but the cause and subsequent remedy seem to have escaped his notice. We have already quoted one well-worn adage, so perhaps it will not add to the offence to quote another, and, in any case, if an apology be necessary to our supercilious critics, we can make a single apology cover both. In any case, it might be well to remind a certain class engaged in electrical engineering work that "a little knowledge is a dangerous thing." This being interpreted according to the needs of the occasion might be read, "If you have experience with continuous current systems only, don't criticise your neighbour when he designs an alternating current one." Should the burden of

knowledge, or the overpowering desire to make a statement for the purpose of seeing if it be right be too great to be borne, it is well to let the disruptive discharge take place before a body of men who can assess it at its current value. In any case, don't go to the daily press with the message.

This is, however, just what Mr. Sydney F. Walker has been doing. He has also prophesied before he knew. The *Western Mail* has all along taken a prominent part in the electric lighting troubles of Cardiff, as it has been the organ in which the various opinions of what is, and is not good for that town, have been made public. It is now made the medium by which Mr. Walker "begs to call attention to a somewhat serious error that has been made in connection with the laying of the electric lighting mains in the streets of Cardiff." The dire results said to necessarily follow from this serious error certainly cannot be passed over in silence. These are:—Magnetisation of the surrounding iron pipes, the generation of heat due to the periodic changes in this magnetisation, a humming noise due to the same cause, a loss of energy leading to excessive fuel consumption at the generating station, and an inability to maintain an equable pressure throughout the network. Then there will be the difficulties attaching to electrostatic charges, and, finally, the gradual destruction of the iron pipes by electrolytic action. And why should all this happen? Because Mr. Massey, who is responsible for the scheme, has arranged for the cables to be laid in iron pipes, the high tension feeders being concentric, and the low tension network being composed of two separate cables lying side by side also in iron pipes.

Can anything be more absurd? After many, we hardly care to say how many, hundred miles of cable have been laid in this way, a gentleman writes from the Cardiff Electrical Works to a local public print to point out dangers which cannot exist, and to prophesy all sort of troubles from a system of mains which is universally regarded as being that *par excellence* from which the most satisfactory results are to be obtained. Thrice is the "loss of energy," which Mr. Walker but no one else fears, due to this "detail of Mr. Massey's scheme" adduced to show what huge blunders have crept into the designs. It is needless to go fully into the objections to concentric cables, to the cast-iron pipes and to twin-single cables, which are freely discussed in all seriousness, but the prophesy would have redounded to the greater credit of the prophet had he waited till he knew whether his surmises were correct. Electric lighting has quite enough to combat (and there is a plethora of questionable work which might be attacked) without having to bear virulent attacks upon a scheme which, judging from the indictment brought against it, is all that could be desired.

Mr. Walker says that he has only been allowed to know what is known to "the man in the street," and that he has only recently discovered the plan of laying the mains that is being adopted. This is his apology for not "having pointed all this out before." It is a pity that Mr. Walker has considered it necessary to point it out at all. As a self-constituted champion for "the protection of the ratepayers who pay Mr. Massey his commission," it can only be deplored that he has not found better grounds for his attack, but at least, the Cardiff Corporation is to be congratulated if the strongest objections which can be taken to their engineer's scheme are those which concern the employment of rubber concentric and double non-concentric cables drawn into cast-iron pipes. The loss of energy, non-uniformity of voltage and electrolytic action, are probably as far removed from the Cardiff network of distribution as they well could be.

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The Electrification of Powders.

In the manufacture of many of the modern military and sporting gunpowders, a substance called nitro-cellulose plays an important part. This substance, whether in the form of grains or in sheets, becomes highly electric if exposed to friction by being shaken up, for example. In this condition the grains or sheets will adhere to each other and to almost everything. If they are faced or glazed with graphite or plumbago, the surfaces become conductive for electricity, and the phenomenon described does not take place. It is not the custom, however, to glaze all powders in this way, and it has recently been suggested by Mr. W. F. Reid, that many of the mysterious explosions which have taken place in Government and other factories may be traced to the ignoring of the electrical excitation which may occur. In Government factories it is the rule to exclude all metal from the interior of the sheds where the powder is dried, or, at least, to cover up all metallic surfaces such as those in the shape of pipes and fittings. Such a shed is often in effect a Leyden jar which becomes charged with electricity when the powder is moved, or the air warmed and set in motion for drying purposes. It is easy to imagine conditions arising in which a spark would occur and the powder be ignited, causing a serious explosion. Of course, the only method of preventing this is by recognising the necessity for metallic connections everywhere which should be properly earthed in the soil. It is curious, however, how long it takes a Government department to carry out a simple precaution which at a private factory would be arranged for as soon as the danger was realised.

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A Novel Application of Electricity as a Thermal Agent.

An exhibit at the Royal Society's *Conversazione*, which attracted by no means the least attention, was Mr. Snedekor's "Thermogen." At first sight one was curiously reminded of some of those wonderful creations which used to emanate from within a thousand miles of the corner of Rathbone Place; but upon closer inspection it appeared what it professed to be, a serious and, withal, scientific application of electricity as a thermal agent. The "thermogen" is a quilt, or cushion, containing a coil of insulated wire, arranged in grid-iron fashion, which is composed of an alloy of known electrical resistance. By connecting up the coil with a source of electricity it is possible to generate heat in accordance with the laws of Ohm and Joule. There are the usual devices for preventing the bad effects of sudden variations in the pressure of the supply, and it is obvious that this electrical quilt, as people are sure to call it, could be raised to a comfortable temperature and maintained there. If quilts, why not coats? In this uncertain climate they would be an incomparable boon. Of course, a *very* light storage battery would be necessary and might be disposed in some convenient portion of the attire. If it became cold during the day after a hot burst of sunshine in the morning, the wearer would then switch on enough current to warm his coat and so defy the elements. In short it is easy to see that an electric coat would be of the greatest benefit to the wearer, since he could go out prepared for any vagary in temperature. But Mr. Snedekor will claim that there is more pathos than bathos about his invention. It is specially designed for the use of invalids and for hospital patients—particularly for those whose misfortune it may be to be compelled to submit to surgical operations. In this direction we should imagine that the thermogen will find a useful sphere of action.

# THE VARIOUS METHODS OF CHARGING THE PUBLIC FOR ELECTRICITY FROM A CENTRAL STATION.

By ALFRED H. GIBBINGS, A.I.E.E.,
Electrical Engineer to the Hull Corporation.

The subject of this paper is of equal interest and of equal import to the engineer of a central station and the public who are supplied from it. The success of a supply company, and the efficiency in the works cost of a central station, will very largely depend upon the method of charging for the current supplied. It is this, in fact, more than anything else, which influences the public mind, and consequently affects the extent to which a demand for supply is created. It will readily be acknowledged that a comparison of methods could not well have been made upon any less data than that which I have here gathered together, and even with the amount of information now at our service, it will be difficult in many instances to form reliable deductions.

The very oldest example of central station supply of any magnitude to which we can refer is that of the Brighton and Hove High Tension Company, which was started in 1881, a date so recent that it can scarcely be said as yet that experience has had time to fully ripen. Nevertheless, comparisons of results have already been attempted by correspondence and through the medium of the technical journals. Engineers-in-charge, companies, and corporation committees, have interested themselves in the question, and there is, in fact, every indication that a consideration of the actual position of affairs would be at the present moment of very great advantage to all interested in the matter. With the exception of those small towns and supply companies that make a definite charge per annum based upon the candle-power of the lamps installed, we may consider for all practical and useful purposes that the following are the methods adopted, viz. :—

1. Separate charges for lighting current and for motor current, registered by separate meters.
2. One general charge, with rebates on a large consumption.
3. Maximum charge based on the number of hours per annum the demand is used, and all excess charged at half price or a different rate.

As examples of these methods I have selected six towns, representing two instances of each method, one being a L.T. station, the other a H.T. station, as follows :—

| Town or company. | Years in operation. | Price per B.T.U. | Method. | System. |
|---|---|---|---|---|
| Hull Corporation ... | 1 | 6½d. and 5d. | No. 1. | L.T. |
| Huddersfield Corporation ... ... ... | 1 | 6d. | No 1. | H.T. |
| Kensington and Knightsbridge ... | 7 | 8d., with discounts. | No. 2. | L.T. |
| Metropolitan Company | 5 | 7½d., do. | No. 2. | H.T. |
| Brighton Corporation ... | 3 | 7d. and 3½d. | No. 3. | L.T. |
| Brighton and Hove Company ... ... | 12 | 7d. and 3½d. | No. 3. | H.T. |

It must not be assumed that these details are significant illustrations of the immediate advantages or disadvantages of the three methods of charging. They will serve for reference in considering the subject, and as the surroundings and characteristics of these districts are well known, it will readily be seen as we proceed how certain principles are modified under special circumstances.

I will now briefly describe the methods enumerated :—

### Method No. 1.—*Separate Charges for Lighting Current and for Motive Power, Registered by Separate Meters.*

This method necessitates the use of two meters, and on low tension systems requires that the circuit on which the lights are run shall be distinct from the motive power circuit. By this arrangement two classes of consumers are dealt with separately, according to the purpose for which they require the supply, and the predominating idea under which this arrangement has found favour is that motive power is generally used at the time of the day or night when the demand on the central station is at its minimum. Consequently, for reasons which are too well recognised by station engineers to need description here, a much lower price per unit is generally charged for this current than for that supplied for lighting purposes. But it must be perfectly obvious that these conditions of supply are frequently reversed, that is to say, large numbers of electric lights for which the *maximum* price is charged are in use in the day time, and many motors for which the *minimum* price is charged are in use throughout the time when the demand upon the central station is greatest.

So far then as the supply companies are concerned, this method can never be an absolute success, nor even an economical arrangement, as much of the current generated during ordinary lighting hours may be earning money only at the lower price. But we may go further than this, and say that the system is not a fair one to the consumer, inasmuch as in those few cases to which we refer, where the higher price is charged at the time of minimum demand, the advantages which should accrue to a customer are lost, and he has no inducement to arrange his lights in an economical manner.

For instance, a large drapery establishment may find it necessary to use 50 ampères all day out of a possible demand of 200 ampères. For the whole of this current the full price per unit is charged, while a possible user of a 10-ampère motor is at the same time being charged at the lower price.

The *advantages*, however, of this method are :—

1. That every customer knows the actual price which he is at any time paying for current.
2. The lower price induces users of small motive power to adopt electricity.

The *disadvantages* are :—

1. When both light and power are required by one consumer, a double rental for meters has to be charged.
2. Unfairness both to consumers and the supply station under those circumstances already described.
3. No inducement to the public to use current for lighting purposes in the day time.

### Method No. 2.—*One General Charge with Rebates on a Large Consumption.*

This is a method which has been adopted by many companies with the obvious intention of inducing a greater consumption of current, by charging proportionately lower rates per unit where a large quantity is used. No doubt the class of inhabitants in the district supplied has very much to do with the appropriateness and success of the adopted method of charging, and hence it would be invidious to criticise too severely a method which, in some particular case, has been found by actual experiment to be satisfactory. But the success of a particular method of charging for current in a special locality should not lead us, as it often leads untechnical men, to the broad, general conclusion, that it must, or probably will, succeed everywhere. I know from experience that there is need to point out how unwarrantable this deduction would be. The character of the district makes all the difference. There are many ways in which the reductions or rebates are effected, due to the different views held by engineers as to the basis upon which reductions should be calculated.

The following are some of the arrangements for rebates :—

1. Rebate deducted from the last quarterly payment in each year and calculated on the amount of the annual bill.
2. Scale of rebates on the consumer's annual consumption of electricity corresponding to a table of units for each 8 C.P. lamp (or its equivalent) fixed on his premises.
3. Rebates on a combination of the foregoing.
4. Maximum price for all units consumed per quarter up to a total equal to a consumption of 8 units per 8 C.P. lamp wired, and a minimum price for every unit consumed per quarter above such total.
5. Sliding scale charge per unit on the absolute number of units consumed.

It will be advisable here to further explain the arrangements just enumerated, deferring a little our remarks on their

general effect in relation to consumer and supply station respectively. The first, second, and third arrangements are adopted by the Kensington and Knightsbridge Electric Lighting Company, and it is apparent that the first and second arrangement must be combined, in order that there may be a legitimate basis upon which a rebate could be granted. If we take the first arrangement alone, it is clear that a mere rebate on an annual bill has no connection whatever with a most important consideration, viz., at what portion of the day the demand has been used? The engineer has only his daily load curve by which he can be guided as to the efficiency and capacity of his plant. He may find that these curves indicate high peaks, which are illustrated at A and B in the accompanying diagram, at the time when the demand on the plant is at its maximum, and consequently when the amount of earning efficiency is low, and possibly enough these peaks may be due to the very customers who get the largest rebates on their annual bills, and who consequently pay the smallest price per unit. Such customers and such an arrangement cannot actually be profitable, for a heavy demand for a short time means nothing less than reducing the available horse-power of the station and keeping capital lying idle. As a set-off, however, against such possibilities, consumers are offered the option of stating the candle-power of their installation, and thereby they come under the second arrangement of rebates either independently of or in conjunction with the first. By this combination some guarantee is assured that the demand is used over a considerable time per day, and to a certain extent an inducement is offered to the consumer to adopt the electric light at other times than at the general lighting hours. But there are also those who, while using current in the day, do not use any at the time of the heaviest demand on the machinery, and it will readily be admitted that here we have a class of consumers whose claims for consideration and encouragement are the strongest, and yet no rebate system offers them any advantages.

Arrangement No. 4 is a very similar method to that just described, but simpler. It possesses the same essential features, but it is calculated to somewhat further encourage a more extensive adoption of the electric light. It is in use by the Metropolitan Electric Supply Company, and their engineer, Mr. Frank Bailey, in answer to an enquiry of mine, says:—

"Since midsummer, 1893, we have adopted a sliding scale, which was done with several objects in view, as in addition to encouraging a day supply, we are anxious to reduce the lamp connection, for we find that the tendency in the houses of wealthy customers is to connect sometimes 500 or 600 lamps for ornamental purposes, and this is obviously to our detriment. We are glad to say that we have found the adoption of this sliding scale as being most satisfactory, for the shopkeepers and others who really require the light are the first to obtain the reduction in price. You will notice we apply this sliding scale per quarter and not per annum. The object for this is too obvious for explanation."

Mr. Frank Bailey here distinctly gives his experience in the matter of the high peaks on the load curves, and the method adopted by his company, viz., a rebate based upon the consumption per 8 C.P. wired, and not upon the total consumption, has at least the tendency to eliminate a most undesirable class of demand.

Mr. Bailey's letter also explains the position with reference to this arrangement of rebates, therefore I will not comment further upon it beyond pointing out that no comparison with other towns is intended, for, as I previously remarked, the success of a particular arrangement very largely depends upon the character of the constituency from an electrical point of view.

Arrangement No. 5 is that of a sliding scale charge per unit based on the absolute number of units consumed.

The remarks already made with reference to the other methods practically cover all that could be said of this one in a general way. Circumstances alter cases, and so this arrangement may be more or less suitable in relation to certain districts. This, no doubt, accounts for the fact that the rebate system in one or other of its forms has been solely adopted in the London districts. Other towns have also tried it, but it yet remains to be seen what has been their experience.

*(To be continued.)*

## STORAGE BATTERY IMPOSSIBILITIES.

Occasionally we read, says the New York *Electrical World*, in newspapers, predictions of the possibilities of the coming storage battery, and some enthusiasts have even prophesied that when "perfected," ocean steamers will be propelled by this popularly misunderstood apparatus. While, of course, every one with an iota of electrical knowledge recognises the absurdity of such a claim, yet an illustration of how absurd it is may be of interest, and to furnish this we will apply the necessary calculations to the case of the new Cunarder, *Campania*. The best trans-Atlantic time of which we have a record made by this ship, whose displacement is 18,000 tons, was 5 days 12 hours and 15 minutes, during which the average speed was 21 knots, corresponding to about 26,000 average horse-power and a consumption of coal for the trip of about 2,700 tons. Assuming storage batteries of 50 lbs. to the hourly horse-power, the entire weight of batteries to do the same work, and allowing for no reserve, would be 76,750 tons of 2,240 lbs., or more than four times the entire displacement of the ship. To determine the weight per horse-power that a storage battery should have to compete with steam in the case under consideration, we will assume that the entire weight of the boilers and machinery of the *Campania* is 3,750 tons, which is probably near the actual weight. Adding the coal consumption for a trip, 2,700 tons, we have 6,450 tons as the entire weight of the electrical plant. Assuming the weight of the electrical propelling machinery to be 1,500 tons, we have finally for the total weight of the battery 4,950 tons. With these data we find that the weight of a battery, allowing for no reserve, would have to be 3·16 lbs. per hourly horse-power. How small this is can be appreciated from the fact that a 150 ampère-hour cell would weigh on this basis only about 1¼ lbs., really about the weight of its lugs. A similar calculation would show the impossibility of storage batteries displacing locomotives, yet the writer knows of a company formed several years ago which spent several thousand dollars in attempting to perfect a battery for such a use. Much of the misconception in regard to the power of the storage battery must be ascribed to the sensational manner in which it was introduced to the public by a very great scientist, his statement in regard to holding "one million foot-pounds of energy" in his hand not yet having lost its effect. The great value of the storage battery in its proper field, which is of vast extent, and as yet scarcely entered in this country, should be sufficient to satisfy its most sanguine friends. Only harm can come from making claims beyond its power to fulfil, and much harm in this way has been done, aside from the absurd instances we have here considered.

## CANDLE-POWER OF ALTERNATING ARC LAMPS.*

In the "Digest" is an account of some elaborate experiments made in Germany with alternating current arc lamps, which brought out several points of much interest. It is stated that the quantity of light from an ordinary alternating arc depends upon the mean value of the current as distinguished from the square root of the mean square value. It follows that since the energy of the current is proportional to the latter, the efficiency of such an arc is greater the nearer the current curve approaches a rectangular shape. This, however, would lead to extreme inductance effects, as well as give rise, it is stated, to disagreeable noises, and the final conclusion of the experimenters is that the best ideal is a true sine curve. Another of the conclusions of the paper is that direct currents are more efficient for arc lighting than alternating currents. Taking a 450 watt (2,000 C.P. nominal) arc lamp as a basis of comparison, we find that the mean spherical candle-power of the same alternating lamps on three different machines was respectively 823, 907, and 970, while with the same energy and a direct current, 1,292 candle-power was developed with a direct current lamp. What is astonishing about these figures is the

* New York *Electrical World*.

quantity of light produced from 450 watt lamps, and which, it seems, is even greater than represented, as a considerable loss in the reflector of the photometer is apparently not included. At the Philadelphia meeting of the American Institute of Electrical Engineers, several speakers, of whom one, Prof. Anthony, had made many hundred photometric measurements of arcs, concurred in upholding a statement that a 450 watt arc, enclosed by a clear glass globe, would not ordinarily give a mean spherical candle-power of 500. As the absorption of the reflector of the photometer in the German experiment is stated to be 30 per cent., which is greater than that of a clear glass globe, the disparity is even greater than indicated by the candle-powers in the two cases, though this amounts to 160 per cent. We cannot question the accuracy of the photometer measurements of Prof. Anthony, nor have we any reason to doubt those of the German experimenters. Neither can we ascribe the differences to lamp mechanism, or to adjustment; the latter in any case would be kept as nearly normal as possible. It would seem, then, that the only explanation left is that the disparity must be considered as due to differences in the carbon employed. It has long been known that the quantity of light from an arc materially depends upon the quality of carbon used, though we are not aware that any comparative experiments have ever shown anywhere as great a difference as above noted. We have been informed, however, by an arc light station superintendent of wide experience, that it is not unusual to come across carbons that will show a difference of 50 per cent. in the amount of light produced. As this is a matter of much importance to superintendents of arc stations and users of arc lights, we trust that one of our college laboratories will take advantage of the excellent opportunity it offers for investigation and experiment.

## NAVAL DYNAMO MACHINERY.

(*Continued from page* 53.)

### III.—Search Lights.

Several kinds of search-lights are now in use in the United States naval service. Some of the vessels are fitted with apparatus of French manufacture; others with projectors of different designs by the Thomson-Houston company. It has been the practice to connect all such lights in parallel, controlling each circuit from the switchboard, where they may all be thrown on a separate dynamo, or if desired, may be worked from the same dynamo which is feeding the incandescent circuits. The former plan is most usually followed, but is by no means necessary, as the damage done to the incandescent lamps by the sudden momentary changes of voltage, caused by the search-lights being thrown on or off, is more theoretical than real. In action, it is intended with plants of the latest type to operate all dynamos in parallel.

Each search-light has its own dead resistance. It has been argued, from economical considerations, that this resistance should be avoided by lowering the potential of the dynamo to that of the lamp; but it has been found that the resistance is of so much practical benefit in the operation of the lamp as to make economical considerations less important than those of good working. In the operation of arc-lights carrying the heavy currents now used, the simplicity of Ohm's law is widely departed from, and the sudden variations of resistance due to the change of position of the arc or to impurities in the carbons, defy all permanent adjustments. Under these circumstances, the dead resistance acts somewhat like a buffer, diminishing the effect of the change and affording a working margin of potential. Any arc lamp operates to better advantage with dead resistance in circuit: and this being the case, it is true economy to waste sufficient energy to secure good operation.

Lieut. Murdock strongly advocates the use of the hand-lamp, and dwells upon the practical objections met with in actual service on board ship when automatic lamps are employed. He points out, however, that the difficulties experienced with the inclined automatic lamp are largely overcome by placing the carbons in line horizontally in the axis of the projector, the crater of the positive being in the focus of the mirror; and by the use of a semi-circular bar regulator. In spite of Lieut. Murdock's objections, however, we observe that the latest additions to the U.S. navy are all furnished with automatic projectors, and in the case of the *New York*, four of the projectors are operated by electricity from the forward bridge. The weight of each of these projectors is 1,980 pounds, but we understand that this will be reduced in future manufacture.

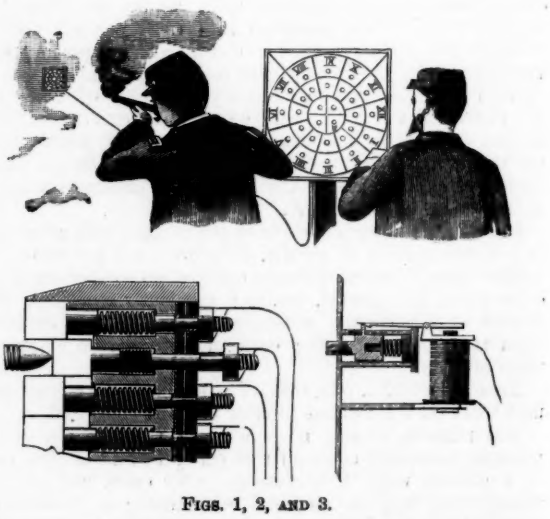
It may be observed that a problem which will have to be immediately determined by experience is whether the advantages of electrical control from a distance are sufficiently great to compensate for the increased expense and complexity, the extra weight, and the greater space occupied.

Lieut. Murdock thinks that there is probably no question of naval outfit in a more unsettled state than that of the utility of search-lights. The fact that they are retained in every principal navy in the world is proof that they are thought to be a necessity. The uncertainty, however, as to their advantages which appear to exist in the minds of a large majority of naval officers is largely due to the fact that these officers obtain but little experience in their use as weapons. Experiments should be made not only to test the conditions of their light-producing efficiency, but to develop the most efficacious methods of using them in attack and in defence, for probably the search-light requires more judgment and skill in its control than any other weapon entering into the equipment of a man-of-war.

(*To be continued.*)

## AN INDICATOR TO FACILITATE TARGET PRACTICE.*

The illustration represents an arrangement whereby an indicator dial at the shooting stand is so connected electrically with the target that the exact effect of each shot may be at once seen on the dial, without the necessity of inspecting the target. The improvement has been patented by Mr. Charles Schifferdecker, of Fort Assinaboine, Montana. The target is arranged in a holding frame, and is divided into radial sections, the bull's eye consisting of four sections. These sections are filled with push buttons, which form the face of the target, and have rearwardly projecting bolts, each encircled by a spiral spring, as shown in fig. 2. In the rear end of each bolt is a conducting plate, from which a wire leads to one pole of a battery including in its circuit one of the magnets of the indicator dial, the different wires from the target being preferably united to form a cable. The indicator dial,



Figs. 1, 2, and 3.

located near the shooting stand, is divided into sections corresponding to those of the target, and numbered consecutively from I. to XII., like the dial of a clock, whereby the score of

* *Scientific American.*

a shooter may be readily reckoned. Behind each section of the dial is a tube with a spring-pressed sliding plunger, as shown in fig. 3, and a pointer which protrudes from the face of the dial when the plunger is released. The plunger with its pointer is normally held in retracted position by a catch on an armature lever, as shown in fig. 3, but when the magnet is energised by the closing of the circuit, which occurs when one of the push buttons of the target is forced backward by the impact of a bullet, the plunger is released and slides forward so as to display the pointer, showing in which section of the target the bullet has struck. If desired, an electric bell may be included in the circuit, so as to ring at the same time the pointer is displayed.

## TELEGRAPHY TO THE FAR EAST.

WE are a little at a loss to know why July 20th, 1894, should have been selected as the date for commemorating the twenty-fifth anniversary of "Submarine Telegraphy to the Far East"—unless as a timely antidote to the recently discussed Pacific cable—for, in point of fact, telegraphic communication with our principal Eastern colony, India, was effected in 1863 (31 years ago, as was, we believe, for once in a way, correctly pointed out in last Friday's *Globe*), by the laying of the first Persian Gulf cable, by Sir Charles Bright, representing Messrs. Bright and Clark, the engineers to the Government.

If we had been celebrating the twenty-fifth anniversary of the Eastern and Eastern Extension Telegraph Companies, we should have understood the date better, and a more worthy occasion could scarcely have been found, for the Eastern Company with its off-shoots is, of course, by far the largest telegraphic system extant.

We were, however, asked to commemorate the silver wedding of telegraphy to the Far East, and though the chairman, Sir John Pender, at the banquet, referred (see the *Times*, for as Sir John and his associates did not deem it necessary, or perhaps politic, to include the ELECTRICAL REVIEW amongst the journals and newspapers selected to report the speeches, although it is not quite unknown in submarine cable circles, either at home or abroad, we are not in a position to give our own version of what took place), to the previous failure of the Red Sea cable in 1859, he did not appear to have remembered that four years later the Persian Gulf cable was laid, notwithstanding that this was the first entirely successful cable expedition of any length, and was thus the means of stimulating further efforts in the direction of another Atlantic cable.

As a matter of ancient history, the Persian Gulf cable of 1863 was, we believe, the first cable that passed through a proper system of testing during construction, the Thomson reflecting galvanometer, being as far as we can remember, in use for the first time, and during the laying the Thomson marine galvanometer was also first used. Many novel methods of testing were about this time, and for this expedition, worked out and introduced by Messrs. Bright and Clark, including Clark's accumulation joint test; and experiments were then made on gutta-percha core in water at various temperatures, which determined the coefficient of variation of resistance by temperature of gutta-percha as being according to a logarithmic curve. The present mode of applying Bright & Clark's cable compound, according to a receipt varied in proportion at will, was also introduced over this undertaking, we believe.

So far as our recollection serves us, it was somewhere about this time that a Parliamentary Committee was appointed to enquire into the question of "The Construction of Submarine Telegraph Cables," there being an idea of another Atlantic cable.

This committee sat for two years, and, after this lengthy accumulation and sifting of evidence and facts, in 1866 the second Atlantic cable was constructed and laid by the Telegraph Construction and Maintenance Company. This was the first cable of any length in which the manufacturers were also entrusted with the laying (indeed, they had not acquired a staff before, and so were unable to tender for the laying), and Mr. afterwards Sir Samuel Canning acted in the capacity of engineer-in-chief, in virtue of holding that position at the time with the Telegraph Construction Company, Mr. Henry Clifford, another modest man, being his chief assistant. Both these gentlemen were engineers of considerable experience and ability, and had previously served in the first Atlantic cable expedition of 1858, under Mr. afterwards Sir Charles Bright, who acted as engineer-in-chief to the Atlantic Telegraph Company, for whom, and by whom, this cable was laid.

We used to be under the impression that the engineer-in-chief of a cable-laying expedition was in some way responsible for the undertaking, and that the captain of the ship was only responsible for its safety and movements on the voyage outward and homeward, and in no way responsible for the cable operations, but of late years we have so often heard (from those who ought to know) that the early Atlantic cables were laid by Mr. Cyrus Field, Sir James Anderson, and others, that our faith on this point is beginning to be rudely shaken. Again, we had previously always thought that Staff-Commander Moriarty, R.N., was in sole charge of the navigation on board the *Great Eastern* in the second Atlantic expedition, but we are beginning to see that it must have been all a dream, and that he and others must have been in reality only passengers!

It is said that if a man makes a false statement a sufficient number of times he really begins to believe in the truth of it himself. It is quite possible also that by asserting at public after-dinner speeches and banquets sufficiently often that he has laid historic Atlantic cables, that any man will begin to believe after a time that he really has done so.

We have always understood that Sir James Anderson was a very able sailor, on a cable ship as well as on a passenger boat, but we presume that Sir John Pender's description of him as having "devoted the best years of his life to submarine telegraphy," refers to his efforts as a shrewd business man in his capacity of managing director to the Eastern Telegraph Company, rather than to any special or original work as a pioneer of submarine telegraphy generally, either from an engineering or electrical point of view.

Sir John Pender in his speech then refers to the services of Morse and Cyrus Field. Mr. Cyrus Field was, we remember, a man of indomitable energy and perseverance, and though he was unable to raise the necessary capital in his own country for the floating of an Atlantic Telegraph Company, he came over to England for that purpose, to find others already equally eager, but eventually by far the greater proportion of the shares were "placed" with Liverpool shareholders of the Magnetic Telegraph Company by its manager, Mr. Edward Bright—at least, so we always understood at the time.

Besides the connection of the Americans, Cyrus Field and Morse, with submarine telegraphy, and that of Sir James Anderson, as aforementioned, Sir John then picked out three names as worthy of reference in this connection, Sir William Thomson, Cromwell Varley, and Fleeming Jenkin. The name of Thomson could, of course, hardly fail to be mentioned in connection with pioneer telegraphy. We all know that both Mr. C. F. Varley and Prof. Jenkin were exceedingly clever men, and that they have both (especially the former, as an electrician) done a great deal for submarine telegraphy in one form or another; indeed, the brothers S. A. and C. F. Varley, actually the former alone, were the first to point out the true law for the working speed of a cable as being equally and inversely governed by its electrostatic capacity and its conductor resistance. This was just after the first Atlantic cable, the core of which, designed by Dr. Wildman Whitehouse, and approved by Faraday, was 107 lbs. copper to 130 lbs. gutta-percha, and, as may be imagined, gave much too high a total conductor resistance. Subsequently to this expedition (it is a pity it was not before) Mr. S. A. Varley wrote two papers on the subject of the qualifications required for the working speed of a cable, one before the Institution of Civil Engineers, and the other before the Society of Arts. The first Atlantic cable failed, after the engineering work of laying it down had been for the first time successfully demonstrated, simply owing to the conductor being of insufficient section, and consequently having too high a conductor resistance. This, unfortunately, induced Dr. Whitehouse to insert an induction coil in the signalling circuit, a potential of some 1,000 volts or more, proving more than the gutta-percha insulation could

stand, especially with the lack of experience in gutta-percha covering and in joints, after six weeks.

Prof. Fleeming Jenkin (a very clever mechanical engineer, amongst other things) in his time took a part in designing the cable machinery of more than one telegraph ship. He also served as consulting engineer to one or two cable expeditions, sometimes aboard the ship, sometimes from his professorial chair at Edinburgh University.

We are not aware, however, that either of these gentlemen were ever placed in the active and responsible position of engineer-in-chief of a cable laying expedition, and it would seem that Sir John Pender has not a very high appreciation for engineers-in-chief, as he so carefully refrained from alluding to their services to submarine telegraphy. We have in mind such men as the brothers J. W. and Jacob Brett, Wollaston, T. R. Crampton, Edwin Clark, Latimer Clark, William and Werner Siemens, H. C. Forde, W. H. Preece and F. C. Webb, besides those already referred to, who, above all, are presumably responsible for the success of these early undertakings. With those electricians Sir John Pender was pleased to refer to, he would have done well to have borne in mind the equal, and in some cases greater, claims of Willoughby Smith, Robert Sabine, and J. C. Laws. But it is the *engineers* that Sir John appears to more especially consider unworthy of recognition. We wonder whether he holds the same views with reference to the Tower Bridge, or any other such engineering undertaking.

It must be remembered that there are many men, though well versed in the problems of submarine telegraphy, who are utterly unsuited, owing to nervousness, excitability, or what not, to have actual charge of the active working of a cable-laying or repairing expedition.

We were glad to notice, however, the useful work of Dr. Alexander Muirhead in connection with duplex telegraphy duly recognised, and a more beautifully made set of instruments to "set before the (future) king" could scarcely be imagined than those some of us had the pleasure of seeing at the reception on Friday evening, including slide (signalling) condensers, resistances for signalling circuits, provided with both slide and plug adjustments, besides the beautiful siphon recorders of Lord Kelvin. We should be glad to know, however, why Bullock and Brown's unigraph is given such an elaborate name. We have often heard of a sounder being put in circuit with a Morse recording instrument at will, or, indeed, of the armature of the recording coils being loaded with something to give a more distinct sound to its movements; but we have never heard of an instrument effecting the same object and apparently designed on the same principle, but of a different form being embellished with such a name.

We believe that some of the guests left the room under the mistaken impression that they had been in direct communication with the Far East, whereas, in reality, they were in direct communication, by Morse "recorders," with the South Kensington Post Office, 100 yards off, by a specially erected wire, and hence to the G.P.O. and the Eastern Company's offices to Porthcurno or Marseilles. The only siphon recorder instruments were being worked together through a Muirhead's artificial cable equivalent to 1,000 nautical miles.

Altogether it was an interesting exhibit of all the instruments used by the largest body of telegraph companies—the Eastern and its allies.

The daily Press has taken part in the applause to those commercially concerned in submarine telegraphy, as is, perhaps, only natural, for they are to a great extent brought up in the belief that these men have done the whole thing; but we, as a technical journal, have thought it only fitting to put in a few words in this connection on behalf of the professional men engaged in the work, and more especially for those entrusted, as engineers-in-chief, with the charge of pioneer cable-laying expeditions. We noticed that the daily Press did not think Jacob Brett, now over 80 years of age, worth mentioning as being present on Friday evening. Presumably, they do not know that he and his brother had been, amongst our countrymen, the principal moving spirits in early submarine telegraphy.

A body of commercial men who unite together and risk their capital in some new scheme of submarine telegraphy naturally look to getting, as they do, the bulk of the advantage, pecuniarily speaking, but they cannot reasonably also begrudge the engineers and electricians the *kudos* for their professional services on their behalf, and take it to themselves. Above all, surely the engineer-in-chief of an expedition deserves some recognition at the hands of capitalists who, in many instances, partly owing to his efforts, have been enabled to pocket a good dividend.

Sir John Pender has done more than anyone else (Cyrus Field included) towards furthering submarine telegraphy, commercially speaking, on his own behalf, and we have no doubt on behalf of his country, and therefore deserves much of the credit and pecuniary profit that is accorded him. This will doubtless be further recognised by his country before long.

With reference to the Pacific cable, from the public point of view, it is pleasant to know that "when the time is ripe," or "if occasion occurs" for such a cable, that the Eastern Company would be prepared to undertake it.

Messrs. Siemens Brothers have already expressed a similar willingness to the Ottawa Conference, and we have no doubt that the Silvertown Company, similarly, would not be found wanting in this respect.

We should much like to know, however, how it is that the soundings of H.M.S. *Egeria* are not found to have served any useful purpose, after a three years' commission in the Pacific Ocean. At least the Ottawa Conference does not seem to view them as having in any way furthered the scheme—and why not, we ask?

## TWO NEW ATLANTIC CABLES.

The number of telegraph cables laid across the Atlantic will this year be increased by two. The first of these was laid for the Commercial Cable Company by Messrs. Siemens and Co., the operation being terminated on the 2nd of this month, the insulation being reported as perfect.

The second cable is that which is now being laid for the Anglo-American Company by the Telegraph Construction and Maintenance Company, concerning the successful laying of which we may expect notice from day to day. This will then bring the number of cables which cross under the waters of the North Atlantic up to 15, of which three have been definitely abandoned as useless, and 11 are still in a more or less perfect state of repair. In these days when competition is so keen, it is absolutely necessary that those companies which desire to hold their own (at least) should see that the service be not interrupted, to insure which continuity, the timely laying of new cables is a requisite step, even in the face of such opinion as that recently expressed by the chairman of the Anglo-American Company, who described the property of his company as "about the most speculative stock you could imagine." The prime cost and the class of cable are, of course, the main things to be considered in view of the present keenness of competition; and when we remember that in 1883 Sir John (then Mr.) Pender said that "the four cables of the Anglo-American Company would cost to replace about 3½ to 4 million sterling," we may deduce from this that each of these cables cost about £850,000, or exactly £400,000 each more than the new Anglo cable, which is greatly superior in class to its predecessors, and would cost about the same price as these to a contractor.

Assuming the new Commercial cable to cost about £375,000, it is easy to understand the advantageous position in which this company stands. With a capital of £2,000,000 and three cables all of a modern type, and none of them older than 10 years, the position of the Commercial Company compares very favourably with that of the rival company, which, when the cable now being laid is completed, will have four cables (bought by private bargain), of which three were laid more than 13 years ago, the new cable being we believe the only one made up in such a manner as to be quite free from the criticism bestowed on some of its predecessors by Mr. W. H. Preece, who, as far back as 1876, expressed himself as follows: "The last Atlantic cable laid is a sample of all those previously laid, and the form of deep sea cable is radically bad. It does not give us a cable of such a form that we can at a future time be certain that we can bring it to the surface again. In the Atlantic cable we have an outside covering of iron wire and hemp, which, in

course of time, must rust and decay." The accuracy of these remarks may be judged from the fact that the Brest-St. Pierre cable (which broke down for the last time over a year ago, and is still interrupted), has, according to the Chairman of the Anglo-American Company, broken down 14 times since 1873, which has cost them something like £240,000. In the criticism above quoted, Mr. Preece omitted to mention, that as the iron wires of these cables are prevented from butting against each other by the intervening hemp, the principle of the arch form, which gives a cable strength and protects the soft core, is not arrived at; and under strain these wires are liable to break one by one, or to be pulled in on to the core. We are glad to learn that in the case of the new Anglo cable this weakness has been recognised, and that the contractors have adopted the method of sheathing the cable which was introduced by the Silvertown Telegraph Company some 12 years ago, where each separate steel wire, after having a preserving compound laid on it, is then closely covered with a prepared tape, and, when made into a cable, is thus well protected against corrosion, and retains the advantage of the necessary arch form. The capital of the Anglo-American Company is £7,000,000, and, after paying for the new cable, the reserve fund will be about £550,000, and their cables four in number, if we except the now useless Brest—St. Pierre cable.

As regards the speed of transmission through these cables, as far as our information goes, the core of the Commercial cable is made up of 550 lbs. of copper covered with 310 lbs. of gutta percha per mile. In this core the conductor is made up in the manner long used by Messrs. Siemens in Atlantic cables, viz., a large central wire surrounded by a number of wires of small diameter. The advantage here is that in a given area the quantity of copper is greater than in an ordinary strand; and thus for a given weight of gutta-percha the inductive capacity will be lower, and the speed of transmission consequently greater. With automatic transmission we may expect this cable to carry 34 words, of five letters each, per minute.

The core of the new Anglo-American is, we believe, made up of 650 lbs. of copper covered with 400 lbs. of gutta-percha per mile. In the making of this core Messrs. Siemens's method of making up the conductor has been adopted, and, although the chairman of the Anglo-American Company recently estimated the speed of transmission at 45 words per minute, we would expect such a core (assuming the length when completed to be 1,850 miles), to give with automatic transmission, at least 57 words per minute. Thus, it will be evident that by their last purchase the Anglo-American Company have, not only as regards diminished cost, but also in an improved class of cable, done something to improve their position.

## LEONARD'S ELECTRICAL HEATER.

Mr. H. Ward Leonard has just had issued to him patent 522,718, of July 10th, 1894, for an electric heater which is thought to mark a very distinct advance in that line. The invention is quite radical, and the patent obtained by him contains very broad claims. The first claim reads as follows: "A device in which electrical energy is converted into heat, having a thinly insulated conductor embedded in, and completely surrounded by, a closely applied mass of metal substantially as set forth."

It is well known that by sending current through a resistance the entire electrical energy can be converted into heat, and as regards the efficiency of the conversion of electric energy into heat therefore no improvement can be effected. The utilisation of the heat developed by the passage of the current through the resistance, however, presents great possibilities of improvement. It is very important for the operation of such tools as electric soldering irons, flat irons, embossing irons, and many other similar tools, some of which are used in almost every industry, that the heat developed in the resistance shall be conducted to the working surface as rapidly as possible, and with the least amount of waste. In electrically heated tools as heretofore made, the conductor was surrounded by a very considerable thickness of fireproof insulation such as asbestos, mica, fire-clay, &c., all of which articles are extremely bad conductors of heat, therefore if the thickness of the wall of such insulation be considerable, the heat developed in the resistance is conducted but slowly through this bad conductor. The conductivity for heat through such insulation is greatly increased by means of a strong mechanical pressure, but no thoroughly successful results have been obtained in apparatus of this nature heretofore made. One of the great difficulties was due to the gradual deterioration of the heated resistance, because of its oxidation by more or less perfect contact with the air through the intervening insulation. Thus in a flat iron, the surface of which comes in contact with damp goods, the heated surface becomes rapidly chilled, unless the flux of heat from the conductor to the heated surface is extremely free and rapid, and with former styles of electric flat irons, in order to maintain upon the surface a sufficient temperature to properly iron the goods, it has been necessary to maintain the conductor at a temperature very much higher than that of the ironing surface, and the conductor, due to its very high heat and exposure to chemical action, such as oxidation, rapidly fails. Also when such an iron is left with the current on, but the iron not in use, the amount of heat radiated from the surface is so trivial as compared with the amount conducted away when the heated surface is in contact with the damp goods that the temperature of the iron runs up to a destructive point, and there is also great danger of burning the goods when the iron is first applied after such an interval of rest.

The necessity of a resistance which would stand a very high temperature has been such that platinum wire is often used in the construction of such tools, the expense of which is, of course, extremely high, but even this has failed under such conditions.

Mr. Leonard has many modifications of the general principles of his invention, but the description of one modification will give a general idea of the invention.

The resistance, which is a metal wire, is thinly coated with some form of fireproof insulation, which hermetically seals the conductor from the air, such as enamel or glass. The wall of insulation around the conductor is quite thin. The conductor so insulated is placed in a mould, and a suitable metal is cast about the insulated resistance, so as to completely embed it in the cast metal. This surrounding body of metal, as it cools, subjects the insulated conductor to strong pressure, insuring perfect mechanical contact throughout. The surrounding metal also hermetically seals the resistance from any possible contact with the air, and from all chemical action. While the insulation surrounding the conductor is of comparatively poor quality as a conductor of heat, the wall of this insulation is so thin that it affords the least possible resistance to the flux of heat from the heated resistance of the surrounding metal body, consequently the temperature of the heated resistance and the temperature at the surface of use will be as nearly the same as possible, and the resistance is therefore not subjected to a temperature appreciably higher than that of the surface of use.

It is possible to operate tools heated by the Leonard system at a bright red heat without any destructive effect whatever, and this possibility opens up a very wide field for the application of electricity to various tools used in the various arts and industries which have heretofore necessarily been heated by gas, charcoal stoves, &c.

The Carpenter Enamel Rheostat Company, of which Mr. Leonard is president, and holds the controlling interest, will manufacture apparatus under this patent.

Among the various kinds of apparatus which will soon be on the market, due to this invention, are the following:—All kinds of soldering irons and embossing irons, all kinds of flat irons and tailor's gooses, all kinds of cooking utensils, such as chafing dishes, broilers, griddle cake bakers, coffee pots, electric stoves, electric ovens, egg boilers, &c., also many applications to small appliances, such as curling irons, sealing-wax heaters, &c. Also, all kinds of atmospheric heaters, such as street car heaters, and heaters for dwellings where the cost of electric current is sufficiently low to make it possible for electric heating to compete with fuel directly. In this regard Mr. Leonard estimates that where power can be had which does not cost more per horse-power per annum than the cost of two tons of good coal, electric heating can compete on the score of economy alone with heat from fuel direct, and the many advantages of electric heaters are so pronounced that they

will frequently be applied for atmospheric heating even though the actual direct cost be much greater than that due to heating by fuel.

## FAREWELL TO MR. GISBERT KAPP.

A very pleasant evening was spent at the Whitehall Club on Monday last by several of Mr. Gisbert Kapp's friends in the electrical profession who organised a farewell dinner and testimonial to that gentleman on the occasion of his departure to take up his new appointment in another sphere of usefulness in Berlin. The company comprised many gentlemen well-known in the electrical world, among whom we noticed Mr. W. H. Preece (presiding), Profs. A. B. W. Kennedy, W. Crookes, Perry, Hughes, Ayrton, J. A. Fleming, S. P. Thompson, Majors Cardew and Bagnold, Captain H. R. Sankey, Messrs. Swan, C. E. Spagnoletti, Elphinstone, Musgrave Heaphy, H. F. Proctor, A. T. Snell, W. M. Mordey, H. Alabaster, Dawbarn, S. Sharp, W. B. Esson, H. D. Wilkinson, E. Garcke, Wm. Robinson, A. H. Preece, Addenbrooke, P. Sellon, J. Raworth, L. Holmes, H. Edmunds, J. Swinburne, Campbell Swinton, Erskine, J. Shoolbred, Mavor, G. Binswanger, H. Hirst, H. E. Harrison, F. H. Webb, W. L. Madgen, C. P. Sparks, Wm. Geipel, and A. F. Phillips, and after an excellent dinner and the usual loyal toast, the more important proceedings of the evening were opened by Professor Ayrton who rose to propose the health of Mr. Kapp. He said that it was his privilege "to speed the parting guest," and in the course of his remarks pointed out that in scientific matters Englishmen know no jealousy, whatever the nationality of the individual admired. He also said that Mr. Kapp, although about leaving us, would remain in the spirit and also in the flesh for he will still have the same home (ohm). In allusion to the Kapp line of force, he remarked that when you think along it you think 60,000 times as powerfully as along the C.G.S. or "common garden sort."

Prof. A. B. W. Kennedy, in ably seconding Professor Ayrton's remarks, said that to recount Mr. Kapp's work was to recall the history of the past ten years.

Mr. W. H. Preece, who presided over the company, then, in a most gracious and eloquent speech, presented Mr. Kapp with a handsome gold watch (of course, non-magnetic), a silver salver inscribed with the names of those present, for Mrs. Kapp a very beautiful album to contain the photographs of the friends left behind in this country. It was also intimated, with many expressions of goodwill, that some article of personal adornment would be added to recall to mind the friends from whom she will soon be parted. Mr. Preece concluded his remarks by declaring that the guest of the evening was as an engineer "sound," and as an electrician "at the head of his profession."

Mr. Kapp, with considerable emotion, responded at length, and said, that although most of the company thought of him as a regular German, his family, on one side at least, was of Scotch descent. He went on to relate his early experiences in this country, and told how in the days, now happily past, he was met by the cry always of "we don't want engineers, we want capital," but at last he fell in with Mr. Crompton, who didn't want capital, and who offered him employment. After some hesitation on account of doubts as to his proficiency to manage the Chelmsford works, his reluctance was overcome by Mr. Crompton not only offering him a salary, but also to teach him his business. He then concluded a very able and evidently heart-felt speech by alluding to the generosity always exhibited by his colleagues in the profession.

Mr. Swinburne, in a humorous speech, proposed the toast of "Consumers and Undertakers," to which Prof. S. P. Thompson responded, after which Mr. Kapp gave that of "Electrical Engineering," to which Mr. J. A. Raworth replied. Mr. H. Edmunds proposed the health of Mr. Mordey, who had taken almost entire charge of the work in connection with the fund and the arrangements for the entertainment, and Mr. Mordey, in answering, proposed the health of the chairman, Mr. W. H. Preece. The latter gentleman replied, and proposed the toast of the "Institution of Electrical Engineers," for which Mr. F. H. Webb responded, and a close came to one of the most pleasant evenings of those it has been our good fortune to spend.

## LEGAL.

### Woodhouse & Rawson United, Limited.

### Public Inquiry before Mr. Registrar Hood.

(*Continued from page* 35.)

The public inquiry into the failure of this company was resumed on Friday, the 20th inst., before Mr. Registrar Hood, at the London Bankruptcy Court.

**Sir RAWSON W. RAWSON** was again called and further examined by the Official Receiver. He said that it appeared that about £80,000 out of the total profits of £100,000 made in 1890 represented the profits on three transactions. He did not consider these profits exceptional, and the directors at the time had a prospect of obtaining a valuable French concession and other contracts. He became aware that his son, Mr. F. L. Rawson, was connected, as a director, with the Phœnix Trust Company and Baron Grant, but he had never heard it suggested that the latter was consulted as to the promotion or formation of the United Company. There was a private telephone between the company's office and that of Baron Grant, but he understood that it was used in connection with the Elmore companies, in which Baron Grant was largely interested.

Mr. F. L. Rawson observed that the telephone connection was not with Baron Grant's office, but between the United Company and the Phœnix Trust, and was paid for by the latter.

Mr. Stewart asked whether Baron Grant's office was not in the same building as the Phœnix Trust, but the witness was not aware of the fact.

In reply to Mr. F. L. Rawson, the Witness said that the opinion of the best patent agents was taken as to the value of the Epstein patents, and the opinion of three or four eminent counsel was obtained as to their validity. The matter had also been thoroughly investigated by the works' committee with the co-operation of their electricians. The board had fully recognised the fact that Mr. F. L. Rawson had made great sacrifices in the interests of the company. When the sum of £28,000 was advanced to the managing director, it was anticipated that he would wipe out the debt by the amount he received from the old company.

By Mr. H. G. Rawson: He had never been connected with the old company or its subsidiaries in any way. He was informed by Sir Albert Cappel that the reason for his retirement was that sufficient capital, which he put at £200,000, had not been subscribed. That sum, however, was reached within a few days of allotment. Sir John Goode also expressed to witness the opinion that the business was a good and sound one. He (witness) had incurred liabilities on behalf of the company as guarantor to the extent of £8,000 or £10,000. During the last 18 months the directors practically received no fees, and during the last year they attended three or four times a week for six or seven hours *per diem*. The £13,000 received by the managing director was at once reinvested in preference shares of the company. To the best of his belief the value of the assets was never exaggerated in any of the balance-sheets, and in his opinion the payment of dividends was justified in every case by the position of the company at the time.

**Mr. F. L. RAWSON** was next called and examined by Mr. Stewart. He stated that he did not hold any considerable number of shares in the limited company. He believed the joint interest of himself and Mr. Woodhouse did not exceed from £10,000 to £16,000. At the date of the formation of the United Company there were 1,978 partly paid shares, representing about £3,000, standing in his name, and he also held shares in the names of others. He also appeared as the holder of 50 shares in the Manufacturing Company, but they were qualification shares, held at the request of Woodhouse and Rawson, Limited. He did not think he had any interest in the 1,383 shares standing in the name of Mr. Woodhouse in that company. On the formation of Woodhouse & Rawson, Limited, the directors refused to allow either witness or Mr. Woodhouse to retain the shares which they held in the subsidiary companies, on the ground that the interests of these might conflict with those of the new company, and the whole of such shares were transferred to the United Company. He appeared to be the holder of 261 £10 shares in the Supply Company, but he could not say whether they belonged to him or not. He believed the 208 shares in the Contract Company were held by him for Woodhouse & Rawson, Limited. At the time of the formation of the United Company he had no interest in the founders' shares of the Limited Company. They were originally held by him and Mr. Woodhouse, but he (witness) sold his interest to his father-in-law, soon after the formation of the Limited Company, at the time when the difficulties with the Edison & Swan Company arose. The books of Woodhouse & Rawson were investigated by an accountant prior to the formation of the Limited Company, and the firm was perfectly solvent at that time. He was aware that Mr. Algernon Harper, who formerly kept the books of the firm, had expressed the opinion that the partnership was insolvent before the formation of the subsidiary companies, but he entirely dissented from that evidence. The firm did not at that time owe any money except what they had given security for. They were not being pressed by any creditor, and had never borrowed money at higher interest than 6 per cent. He (witness) had no accounts which would show the position of the firm in 1886, but Messrs. Spain, the accountants, went through their books in that year, and on the strength of their report a sum of £2,000 was borrowed by the firm at 5 per cent. The only document bearing on the subject which he had been able to find was a memorandum, which showed that about this time the firm were about £16,000 to the good. As a matter of fact, in 1884, when many electric companies were coming out, an offer was made to buy their business for a very large sum, and was refused. It

was true that the balance-sheet of the Manufacturing Company, dated June 30th, 1889, showed a deficiency of £44,000, after allowing £37,265 for goodwill; but the value of the patents was not taken into account in this balance-sheet. In the balance-sheet of September, 1890, after allowing for the £33,500 paid for the business by the United Company, there appeared to be a deficiency of £70,000. He did not think, however, that this correctly represented the position, as he had always considered that a sufficient price was not paid for the business of the Manufacturing Company. In the balance-sheet of June 30th, 1889, there appeared to be an accumulated debit against profit and loss account of £35,000, after taking the goodwill at £37,000, but that figure did not include anything for patents, or for the benefit of the arrangement made with the British Company for the manufacture of lamps. In 1887, Messrs. Chandler & Pixley reported that there had been a net loss of £2,000 on the trading, and in October, 1888, the business of the year had resulted in a loss of £2,903. The company, however, had done a prosperous business in the previous year, and the loss in 1888 was due to the fact that the lamp business had been stopped, and that they had been obliged to write down the stock of lamps held by them to a merely nominal value.

The enquiry was then adjourned to July 24th.

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The enquiry was resumed on Tuesday, the 24th inst.

Mr. F. L. Rawson was again called, and further examined by Mr. Stewart, the official receiver. Questioned as to the position of the Supply Company in October, 1888, he said that the interim dividend of that year was declared on the strength of a large profit which had been made in connection with the Welsbach lamp, and also of an amount which had been carried forward from the previous year's trading. He had not been able to find the accounts of the company for 1888. The position of the company, however, was a good one at that date, as, though they were unable to do much in the manufacture of their lamps, they had worked up a large business in other goods. The whole of the book debts taken over by the Limited Company were guaranteed by Woodhouse and Rawson. It was not the fact that the debt due by the Manufacturing Company was not discharged, as considerably more than the amount guaranteed by the partnership was paid by the Manufacturing Company. The firm were advised that the guarantee of the partnership ceased to have effect upon the formation of the United Company. This view was contested by Mr. Hoster as liquidator of the Limited Company, but the solicitors who were consulted in the matter advised that there was no liability on the part of the firm. The Electric Contract and Maintenance Company was formed in 1886 to amalgamate the business of the Crossley Telephone Company, Limited, Halifax, with that of Messrs. Woodhouse and Rawson in the North of England, the amount paid to the vendors being £5,000. It was the fact that the accounts of the company showed a loss throughout, but it was steadily diminishing, and, on the other hand, the goodwill was constantly increasing. Sir John Crossley, who was the leading member of the firm, was a director of the London and North Western Railway, and was able to introduce a large amount of valuable business. This connection alone, in witness' opinion, would constitute a valuable goodwill.

Mr. Stewart pointed out that the goodwill of the company was taken throughout at £5,000, and asked witness whether a business which was being carried on at a loss could be considered to have any goodwill at all.

Mr. Rawson replied that most businesses of the kind did not make any clear profit when first started, though they might have a certain prospect of doing so, and it was this prospect of eventual profit which constituted the goodwill. The witness was then questioned as to the relations between himself and Baron Grant with reference to the promotion of the company. The witness said that in 1888 he heard that Baron Grant was forming a company to carry out certain electric works at Hammersmith, and to combine certain other businesses with it. He (witness) applied for and obtained the contract for the works, which amounted to over £100,000. He was at that time negotiating the amalgamation of the Manufacturing Company with other businesses, and Baron Grant asked whether they could not be combined with the businesses which he then had in hand. Baron Grant had nothing to do with the affairs of the company after the directors went to allotment, but he (witness) consulted the Baron on several occasions during 1889. At that time he (Mr. Rawson) was acting solely in the interests of the vendors and had no communication with the directors or solicitors of the United Company.

Mr. Stewart referred the witness to several letters and telegrams which passed between him and Baron Grant at this time.

Mr. Lawson said that these referred to various points connected with the formation of the company, upon which the Baron required particulars. He (witness) wished to say that Baron Grant was most particular in being satisfied upon all important matters connected with the company.

Mr. Stewart observed that he did not wish to cast any reflection upon the advice given by Baron Grant or upon his capacity to give it. He only wished to ascertain who advised or assisted in the formation of the company.

The Witness, continuing, said that he first consulted Baron Grant as to articles appearing in the press, and the best way of dealing with them. Baron Grant's experience in such matters was A1, while his (witness's) was below zero (laughter). The Baron's advice in general was to take no notice of press criticisms and not to write letters contradicting or controverting the statements made in them. As a matter of fact, he (witness) believed that not a single letter was written by Woodhouse & Rawson to any newspaper, except on purely technical matters unconnected with the promotion of the company. Baron Grant afterwards represented that he was entitled to some compensation for having foregone his intention of bringing out the electric companies which he had in hand in 1888, and it was eventually arranged that the Limited Company should pay him a consultation fee of £5,000. The Baron raised some objection to the sufficiency of this amount, and witness accordingly promised him a percentage upon the profits which he himself was to receive, and which would have represented a further £7,000. Witness's profits, however, turned out to be nothing, and the Baron accordingly received nothing beyond the £5,000 for all his services in connection with the limited company and the formation of the United. Baron Grant was never consulted as regards any of the other companies. The arrangement referred to was not made directly with Baron Grant but with the National Financial Corporation, of which the Baron was the chairman. The arrangements made with the Phœnix Trust were not entered into in consideration of Baron Grant's services in the flotation of the United Company. The prospectus was prepared by him (witness), but he consulted Baron Grant as to the financial part of the scheme. The amalgamation scheme was discussed during the whole of 1888, and the question of the composition of the Board was also considered. Several of the vendor firms were desirous of being represented on the board, and many names were submitted during the early stage of the negotiations. He did not admit that the valuation of the patents to be acquired by the new company was made by his instructions. He contended that it was prepared on behalf of the directors of the new company.

Mr. Stewart pointed out that Mr. Edmunds's valuation was made some time before the formation of the board.

The Witness replied that it was known at that time who the directors were to be, but he could not mention the names of any who gave instructions as to the valuation being prepared. At a meeting of the board in October or November, 1890, he (witness) informed the directors of his connection with the Phœnix Trust, and offered, if they wished, to surrender the shares which he held in that company, and also to return the dividends which he had received. The directors, however, did not see any objection to his retaining these shares. He was not aware that, with the exception of Sir Rawson Rawson, all the directors had denied any knowledge of the fact until a much later date.

Mr. H. G. Rawson said he was in a position to show that the managing director's connection with the Phœnix Trust, and his pecuniary interest therein had been fully disclosed to the board soon after the formation of that company, and he asked to be allowed to recall Sir Rawson Rawson for the purpose of proving this fact.

Sir Rawson Rawson was accordingly recalled and stated that he was aware of his son's connection with the Phœnix Trust before it was actually formed. His recollection was that in 1890 Mr. F. L. Rawson reported to the Board the difficulty which was experienced in disposing of the Elmore shares *en bloc*, and the formation of the Phœnix Trust for the purpose of floating the shares. He could not say which of the directors were present at the time, but the matter was fully explained to the Board and was discussed by them.

By Mr. Stewart: He was not aware that the only shareholders in the Phœnix Trust were Mr. F. L. Rawson, his wife, the National Financial Corporation, and Baron Grant, and he did not think it material that the information should have been given. The material point was that the company had been formed to enable the United Company to dispose of these shares, and he should have considered the persons named quite competent to effect the object in view. He was aware that his son had a large interest in the Trust, but did not know whether he was told the exact amount of it.

By Mr. F. L. Rawson: Before the formation of the Phœnix Trust, the United Company received offers from several trust companies to carry out exactly the same arrangement as that which was come to with the Trust, but for various reasons these offers were not entertained. It was the fact that the managing director voluntarily gave up 25 of the 50 founders' shares held by him in the Trust for the benefit of the United Company.

Mr. F. L. Rawson was then examined by Mr. Stewart with reference to the circular sent to the shareholders announcing the withdrawal of three of the directors prior to the allotment. It was true that the circular did not contain any reference to an option being given to the shareholders to have their deposits returned, in accordance with the terms of the resolution of the Board. A copy of the circular was sent to each of the directors for approval in the usual way, but he could not give the name of any director who formally approved it. He could only explain that the omission was due to the "rush" which took place before going to allotment. He would point out that most of the applicants for shares would be perfectly aware that they were entitled to a return of their deposit right up to the date of allotment.

His Honour: The question is, Why this, the essential part of the resolution, was omitted in the circular, although it is clearly recorded in the minute? However, that will be a point for comment hereafter.

Questioned as to the figures in the balance-sheet for June, 1891, the witness denied that the profits shown had been derived exclusively from financial operations. The profit shown on the Epstein securities was the result of purely industrial business. It was true that Mr. Pixley, the auditor, advised the directors not to declare a dividend upon the figures shown, but, as a matter of fact, it appeared to be a general principle with that gentleman to recommend that directors should not declare a dividend until they were obliged to do so.

Mr. Stewart read a letter written by Mr. North, the manager, to witness, in which he strongly deprecated the policy of declaring a dividend.

Mr. Rawson replied that after the receipt of this letter he saw Mr. North and pointed out to him that he had entirely misconceived the effect of the figures. He afterwards received what he characterised as "a trimming letter" from Mr. North, in which that gentleman practically withdrew his previous communication.

Mr. Stewart read Mr. North's second letter and remarked that he

was unable to construe it as in any way a withdrawal of the previous one.

The Witness said that he probably informed the Board of the contents of Mr. North's letter, but he could not specify any particular director with whom he discussed the matter.

The examination was then further adjourned to Friday next, the 27th inst.

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The Cassel Gold Extracting Company, Limited, *v.* The Cyanide Gold Recovery Syndicate, Limited, and Others.

First Day.—Monday, July 23rd.

In the Chancery Division of the High Court of Justice, the trial of this action came before Mr. Justice Romer. The plaintiffs' case is, that they are the registered owners of certain letters patent, numbered 14,174 of 1887, granted to John Stewart MacArthur, R. W. Forrest, and Wm. Forrest, for improvements in obtaining gold and silver ores and other compounds. They allege that the defendants have at various times infringed their letters patent by employing a process of obtaining gold and silver from ores, consisting in dissolving them out by treating the powdered ore or compound with a solution containing cyanogen, or a cyanide, or a cyanogen yielding substance, substantially as described and claimed in the specification. The plaintiffs accordingly claim the usual relief in a patent action. In the particulars of breaches the plaintiffs complain, in particular, of the construction and use, and exhibition by the defendants, of plant erected in the laboratory of B. H. Harland, F.I.C., F.C.S., Plough Court, 37, Lombard Street, for the treatment of ores for the extraction of gold and silver.

The defence is a denial of the infringment, and an allegation that the plaintiffs' letters patent are not valid. The particulars of objection to the validity of the letters patent state that the alleged invention was not subject matter for a patent, in view of the state of knowledge at the date, and having regard to prior publications. Objection is taken to several of the statements in the specification on the ground that they are insufficient and misleading; and the alleged invention, as claimed in the second claiming clause of the specification, is said to be different from that for which the patent was applied for, and is not indicated or referred to in any way in the provisional specificatien. It is further said that the alleged invention was not new at the date of the patent, having been published in a number of specifications which the defendants rely upon as anticipations.

Sir R. Webster, Q.C., M.P., Mr. F. Moulton, Q.C., M.P., Mr. Bousfield, Q.C., M.P., and Mr. Walter (instructed by Messrs. Davidson and Morriss) appeared as counsel for the plaintiffs. Sir Edward Clarke, Q.C., M.P., Mr. R. Neville, Q.C., M.P., and Mr. Goodeve (instructed by Messrs. Burchell & Co.) for the defendants, the Cyanide Gold Recovery Syndicate, Limited; Mr. Goodeve appeared for the defendant Pielsticker; Mr. Bowick appeared in person.

Sir R. Webster said that he was informed that since the proceedings commenced the Cyanide Gold Recovery Syndicate had altered their name to the Electro-Cyanide Gold Recovery Syndicate, and be asked to be allowed to add the latter name as parties.

Mr. Justice Romer: Be it so.

In opening the case, Sir R. Webster said that the patent was for a process of extracting or recovering gold from the tailings. It had been put in practice, particularly in South Africa, to a very large extent. It would be proved that between 600,000 and 700,000 ounces of gold had been successfully extracted by this process, representing a value of £2,500,000, and royalties paid to the extent of £117,000 in connection with the processes so used. There had been a variety of methods of extracting gold, chemical and mechanical methods, known as the amalgamation process, the chlorination process, &c. But prior to the Forrest and MacArthur patent there was no commercial method of extracting the residual of the gold from tailings or washings of gold ore, and unquestionably if his evidence were true a very considerable amount, and a very great value of gold, had been washed away and lost to the world through there being no method of its recovery. The defendant set up anticipations of the plaintiffs' patent which extended back for a great number of years, but on his instructions nothing had been added to the useful public knowledge of this matter since a discovery or statement of Prof. Faraday in the year 1857. At the date of the patent it was known that metallic gold in a state of fine division, or in the form of gold leaf, was in the presence of oxygen slowly soluble in cyanide of potassium. It was also known that when gold was used as an anode in the solution of cyanide of potassium, and connected with a battery so that a current of electricity was passing through the cyanide of potassium, the gold would be attacked by the cyanogen being set free by the action of the electric current, and would pass into solution in the cyanide of potassium as a double cyanide of gold and potassium. But it was practically unknown that you could operate commercially or effectively upon crushed or powdered ore by a solution of cyanide of potassium so as to extract the gold from the ore. The simple process of MacArthur-Forrest's discovery was this: that you could take ore in the bulk and crush it, and then by using a solution of cyanide of potassium you were able commercially to extract the gold in solution from the ore and get a very large percentage of the quantity of gold, extract the gold from that ore in the form of a solution, and then redeposit it by zinc or other methods of getting the metal out of the solution. That had never been successfully carried into effect before. Another very important thing discovered in this line of invention was that a dilute solution of cyanide of potassium had a special and valuable selective action—it took out the gold and silver before it attacked the other and baser metals. Another thing discovered by MacArthur and Forrest was that to pick out practically and commercially the gold from the ore in the quickest and purest way, by using the dilute solution. The learned counsel then proceeded to deal with the specification, and to explain the invention by means of models. The first claim, he said, was for the use of cyanogen in the way described, and the second for a particular proportion of the cyanogen in the dilute solution.

Mr. Justice Romer: Let me see what, shortly speaking, your case is. It is known that a certain solution will dissolve gold, and you say, "Apply that solution to the crushed ore, and that will dissolve the gold and take it out."

Sir R. Webster: It is known that a certain solution will dissolve gold under certain conditions.

Mr. Justice Romer: Not under all conditions?

Sir R. Webster: No; if you put into cyanide of potassium a small lump of gold, it will remain there practically for any length of time. The condition under which it has been found, only experimentally to act, was if you had very finely powdered metallic gold, cyanide of potassium had a slowly dissolving effect. The merit of this invention is the appreciation of the fact that you can apply that limited operation to the set of circumstances in which gold is found in ore.

Mr. Justice Romer: Do you mean to say that if you put a lump of gold in cyanide of potassium, and stir it up, it will not gradually crumble away.

Sir R. Webster said it might do so ultimately, but it would take a very long time, and even then oxygen must be present.

Mr. Justice Romer: It must.

The learned counsel then proceeded to state what the defendants had done. There was no dispute, he said, as to that; the sole dispute was as to the deduction from the facts. They erected an experimental laboratory, and advertised for persons to come and have their ore tested by what was called the Pielsticker process. Pielsticker was the gentleman who had purported to invent the infringing process. The defendants had permitted the plaintiffs to inspect what was being done. The suggestion made by the defendants was this: That they were not working so as to obtain gold by the dissolving action of the cyanide of potassium, but that they were working by electric action, which had the effect of extracting the gold electrically, and not by the process which Messrs. MacArthur and Forrest had described.

Mr. Justice Romer: If I understand you, your patent is, broadly speaking, for extracting the ore by mixing it with a solution of cyanide of potassium.

Sir R. Webster: Certainly; and I say that was done for the first time. The whole of the alleged anticipations, if you were to fuse them into the mosaic of which Lord Justice James used to speak, would never have led anybody (according to my instructions) to believe or think that this process could be commercially applied. It never had been commercially or practically used until Mr. MacArthur and Mr. Forrest did it, and Mr. Pielsticker's iuvention was never suggested until long after MacArthur and Forrest's invention had been fully described.

Evidence was then called for the plaintiffs.

Prof. James Dewar, F.R.S., who, asked as to his qualificntions, modestly said that he had a fair knowledge of chemical science, described in technical language the operation of the plaintiffs' and defendants' patents as he understood them, and the use that had been made of cyanide of potassium as a means of extracting gold from ore. Before this patent it had never been used for commercial purposes. The instructions in the plaintiffs' patent were sufficient to enable persons to use this process, which worked admirably in the laboratory, and had been an enormous success in the commercial world. Witness had seen the Pielsticker process, and gave it as his opinion that the separation of the gold from its ore was there brought about by the solution of cyanide of potassium.

Cross-examined by Sir Edward Clarke: Do I understand you to say that it was not known before the date of the plaintiffs' specification that cyanide of potassium would dissolve gold?—I say that it was then known that under certain conditions cyanide of potassium could dissolve gold.

That had been known for 30 years?—More especially since Faraday's paper.

Mr. Justice Romer: What conditions do you refer to?—Gold in a fine state of division and heat.

Sir Edward Clarke: I put it to you that it was not believed that heat was essential?—I do not agree with you.

If you get the gold in a fine state of subdivision, heat is not essential?—It is essential to produce any practical result.

Was it not said in Elkington's patent, of 1840, that with gold in a state of minute subdivision, the cyanide of potassium would attract it without the addition of heat?—I say it was not known to me.

Do you, as a chemist, attach importance to the question of its being a dilute solution?—Undoubtedly; that is the most effective mode of carrying out this operation.

What do you mean by a dilute solution?—Anything below 5 per cent.

Is it not the fact that any solution, whether dilute or strong, affects the metals in the same order, although it may be from the rapidity of effect that order is not easily discoverable?—As a generality, I should say yes.

Do you agree that a dilute solution has a selective action?—Undoubtedly, because you get less attack on the other metals.

Witness then went on to say that in Rae's specification, dated 1867, the ore was placed in cyanide of potassium solution, and treated electrically. There was nothing in common between Rae's method and that of the defendants. Pressed as to this, witness admitted that in each case the ore was placed in a solution of potassium, and in each case the electric current passed through the solution.

Mr. Justice Romer: It appears to me extremely like the defendants'.

Witness admitted that in principle they were the same. Rae's process was never worked, and never was a success. He declined to go into the causes which made Rae's fail, or to follow counsel's sug-

gestion of a method to make Rae's work. It was not common knowledge to the witness that cyanide of potassium was effective for dissolving gold from its ore.

Sir Edward Clarke: Sanders's specification of 1881 says: "I am aware that cyanides have already been used in the extraction of gold," &c.

Witness said that that was an American publication. In answer to further questions, he said that Simpson's claim was for the process of separating metals from their ores by subjecting the ore to a solution of cyanide of potassium, carbonate of ammonia, and chloride of sodium, and subsequently precipitating the dissolved metals. When this specification was produced, he would have attributed importance to the presence of carbonate of soda and chloride of sodium, but he would not do so in his present state of knowledge.

In re-examination by Sir R. Webster, Witness said that an operation which would dissolve gold might be ineffectual when applied to gold and its ore. The heat he had spoken of was to produce the solution which was to be used. In Rae's patent there were two electrodes, and the electrode in the first tank had nothing to do with the solution of the gold by the cyanide of potassium. In Rae's there was no indication that you could get at the solution without electricity. The claim in Rae's would not guide anybody to the MacArthur and Forrest patent. Rae's patent was certainly never used in England; as far as he knew it was never used at all. Taken to the Sander's specification, witness gave it as his opinion that so far from leading people to the use of cyanide of potassium to dissolve gold, it would lead them away from the object of the plaintiffs' patent. As far as his knowledge went, neither Sanders's nor Simpson's had been used in England.

Adjourned for the day.

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Second Day.—Tuesday, July 24th.

Prof. Roberts Austen, F.R.S., and chemist of the Royal Mint, said that he was well acquainted with the various processes for the production of gold from its ores. In 1887, he had never heard of the production of gold from its ores by means of cyanide of potassium, and had no reason to suppose that it would be effective. In 1887, if anybody had suggested the treatment of powdered ore with a solution of potassium, he would have thought it not to be efficacious. In his opinion, nothing in the particulars of objection threw any light on the subject. Before 1887, the great bulk of gold was extracted by the amalgamation process, by which almost any ore might be treated. Then there was the chlorine process, and a still further process of smelting with lead. The cyanide was the first really effectual process. Roughly, 500,000 ounces of gold had been produced by it—a very considerable portion of which would have been wasted in any other process. He considered this process to be very important in the gold production of the world. A large proportion of the bullion which came into the London market the last year or two had been extracted in South Africa by means of this process. Witness then corroborated the evidence of Prof. Dewar generally, and with regard to Simpson's patent, he said that he had made certain experiments on a small scale, and found that the carbonate of soda tended to break up the cyanide. In Rae's process the electric current had some influence.

Mr. Justice Romer: How does the electricity act differently in Rae's from the defendants in promoting the solution?—In the case of Rae's the particles of gold are brought in contact with the anode, while in the defendants' they are suspended. The electricity in the defendants' process has no effect in promoting solution.

Cross-exanined by Mr. Neville: In Mackenzie's "Chemistry Applied to Arts," it was stated, amongst other things, that Faraday found that ordinary gold leaf might be reduced in thickness without destruction by means of cyanide of potassium, and that "cyanide of potassium was employed in the reduction of the rarer metals from their ores." So far as he knew, however, no such use was made of it. Following Faraday, all the books had referred to the solubility of gold in cyanide of potassium. The solution acted on the surface of the gold, and it would necessarily act in the case of gold in a state of fine division. The system of obtaining the ore from the solution was known at the date of the patent, which was concerned solely with getting the gold into solution. In all these commercial processes the question was one of cost, and at the date of the patent there were difficulties in getting the gold out of solution, a large proportion of it being lost. The best known method was running it over zinc, and subsequently zinc shavings were used and patented by the plaintiffs.

By His Lordship: Rae's patent got a solution for gold, and Rae would have completed the problem if he had found a proper method of extracting the gold from the solution. But Rae thought that electricity would answer.

Lord Kelvin, P.R.S., examined by Sir R. Webster, said he had seen the model in which the Pielsticker process was worked. The process of extracting the gold from the fluid solution was perfectly well known, namely, by electro-deposition. The anodes and cathodes in C had nothing to do with the anodes and cathodes in A. He ascertained that the current supposed to be used in the circuit between the anode and cathode, H and G, was three Smee cells, which would be about 2 volts when fresh. The box was filled with crushed ore, which would consist of mineral and metallic matters, and gold or silver, as the case might be. Beforehand, he would judge that the electric current would have practically no effect in promoting the solution. He had made experiments himself that proved to him that it would rather have an injurious effect than an aiding effect. If it was an efficient method of extracting gold by electricity, he would expect to find the gold on the cathode, G, in the tank, A. Witness then explained to the Court, by means of a model, and said that the five discs that were affected by the current showed less loss than the five discs that were unaffected by the current. The outside strength of the current was 1 volt, and the ampèrage a fraction of an ampère. In his opinion that was a fair test to ascertain whether the electricity had a beneficial effect or not. He wished to add that he was unable to offer a theory as to the cause of the result, but the result was undoubted. That the pieces of metal were in some way affected by the polarisation introduced into the liquid by the current, he thought was proved by the result. It might be that the smaller amount of metal dissolved off the discs in the course of the current was because of the solution having become impaired, partially decomposed, and cyanate of potash formed. He thought probably the result was due to that, but it might also be due to the presence of the natural electric solvent action of the liquid. The witness then put in and explained two formidable tables dealing with the experiments, the result of which he had just stated. Taken to the specification of Rae, he said it was a method of electro-deposition. He would expect that the strength of the solution might affect its action, and that a strong solution might dissolve metals in a different order from that which the weak solution dissolved them, he was aware that Faraday was referring to the solution of gold leaf, and the relation of area to mass in question of solution was very important. Asked whether anybody could predicate from this paper that there would be dissolving action upon other conditions of gold, he said that he did not think that it could be anticipated that there would be any sufficient dissolving action to be useful in practice upon metal in the shape in which it occurred, and with the surroundings in which it necessarily was in crushed ore. Faraday's experiments were with reference to a large surface of very thin gold, and where you had rough matters and rough things of the same nature the results might be entirely different, because the solution might be prevented from getting at the greater part of the surface of the metals. He did not think Faraday's paper would lead anyone to the practical process of dissolving gold out of ore, but it might suggest the trial.

Cross-examined by Mr. Neville, Q.C.: He had made no scientific investigation of gold ores, but he knew a good deal about them. In all cases of solution the effectiveness of the operation depended upon the exposure of the surface of the metal to the dissolving agent. The gold supplied for the purposes of the experiments was, he believed, pure gold. Probably it had been melted, but there was no reason why it should be annealed. Practically, it was in the state in which it would occur in gold ore, he supposed, except that in the gold-bearing ore the surface was sometimes skinned over with sulphide or with oxide. He did not know whether the gold experimented with had been melted or not. The same liquid was used in both tanks. He did not apply any tests to ascertain whether his supposition that the result he observed might have been from the deterioration of the solution, was true or not. He did not, however, think it was deteriorated to a sufficient extent to diminish its solvent power. By the polarisation he had described the metal was protected for the time being from the action of the current, and it was because of that that he expected very little current to pass through the solid gold particles in the gold discs. He did not think that a current of liquid passing through the tanks would affect the polarisation in this sense of the discs. Agitation of the liquid in the tanks might, in some cases, have the effect of removing the protection from the surface of the metal, but he did not think that in the case of his experiment it would have altered the result. He could not say without further experiment. The discs of gold he used were not exactly in the same condition in which gold was found in the ore—not so minutely divided as in the crushed ore—but another experiment was arranged for under his cognizance, and he had seen the results of it, in which the gold in the crushed ore was subjected to an experiment exactly similar to his on the discs and wires. Somebody else would speak to that. Asked as to the Pielsticker process, he said that with ore containing fragments of gold placed on the anode, H, and with the electricity going through the solid plate, the tendency would be to turn that little fragment of gold into a cathode on the lower side and an anode on the upper. The tendency of the current of electricity would be to dissolve the gold on one side and deposit as much on the other. The minuteness of the gold under operation would not affect this result, so far as the electrical cause was concerned. It would not dissolve under the operation of the electric fluid. The reduction of weight in each of his five discs was not the same. On disc A, next the anode, the loss was ·388 of a gramme; on disc E, next the cathode, the loss was ·384 of a gramme; the mean of the five, ·381. This might be caused by slight differences in the surface of the gold, and the character of the piece of gold, and so on. He made no experiments to ascertain the state in which these little particles of gold were found in the crushed ore, and there was a vast difference in the different ores in different parts of the world. His experiments led him to believe that the same results would be obtained with regard to all ores, notwithstanding the vast difference in their composition. According to his view, under the conditions in which this electricity was used in Pielsticker's process, the electric current in tank A was detrimental to the extent of 7 per cent. of the object to be attained by the process. If the result of other experiments were the other way, his confidence in his experiments would not be shaken.

Re-examined by Sir R. Webster: From the point of view of electrical deposition, Rae's might have been a successful method. If it was an electrical deposition that Pielsticker was carrying out, he would expect to find the ultimate gold upon G. In his judgment the electrical action retarded the solution, and impaired it. The electrical conditions in Rae's illustration and the gold leaf were not, in his opinion, the same as the electrical conditions and the finely divided ore in Pielsticker's. In the first place the leaf was suspended across the path of the two metals, screening the current, unless the current passed through the gold. Under the ordinary conditions which that picture showed, some of the electricity would pass through the gold leaf, a considerable portion, probably. In the case of gold in the ore, there would be a very much smaller portion of the

current passing through the end than in the case of gold leaf across the line of current. Assuming that process to be carried out of dissolving the leaf with the electrical current, the gold would be found first in the solution, and if the process was carried on long enough, it would probably all be taken away. What was left would be on the cathode. Whether the discs of gold used in the experiments were annealed or not, he could not say, but he knew that it was of no importance.

Mr. Edward James Mills, F.R.S., and professor of technical chemistry in the Glasgow and West of Scotland Technical College, said that the specifications alleged to be anticipations did not disclose the use of cyanide of potassium for the extraction of gold from its ore. The remainder of the witness's evidence was in agreement with that given by the previous witnesses.

In cross-examination he admitted that Rae's process was efficient for dissolving the gold in the ore. With regard to Simpson's patent, he thought that cyanide of potassium and carbonate of ammonia were linked together to form a solvent. He was present at the experiments made in the case, but they never took the defendants' actual apparatus for the purpose.

Mr. Justice Romer said that the sole question was whether the electricity going through the defendants' apparatus did have the effect of assisting solution, and asked witness why he did not try that.

Witness said that their experiments were conducted in a simple and trustworthy form, and there was nothing in the apparatus used which would vitiate the results.

Mr. Robert Tatlock, F.R.S and F.I.C., said that he was the public analyst for Glasgow. Witness was the author of the article on "Cyanide of Potassium," relied on in the particulars of objection, which said that "nearly all the cyanide of potassium made is used in electro-gilding, &c. It is also applied in the reduction of some of the rarer metals from their ores." That referred to the dry process, and not in any way to the wet process. The witness then corroborated previous witnesses as to the results of experiments, and as to cyanide of potassium being the effective agent in both the plaintiffs' and defendants' methods of extraction.

Cross-examined: For the purposes of the experiments they used fresh ore, and not the tailings to which the apparatus was designed to be applied. There was no intended agitation in their experiments, as there might be in carrying out the plaintiffs' process; but he could not conceive that that was important.

Dr. George Gore, F.R.S., &c., said he never knew gold dissolved directly in cyanide of potassium for the purpose of forming a solution. Electricity was used in connection with electro-plating.

Cross-examined: Rae's and the defendants' processes were alike successful in dissolving the gold in the ore.

Sir Henry Roscoe, F.R.S., said that the plaintiffs' process had rendered the economical extraction of gold from tailings possible. In the alleged anticipating specifications there was no case in which the cyanide of potassium alone was used for the purposes of extraction.

The Court then rose for the day.

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### Andrews & Preece, Limited.

In the Chancery Division of the High Court on Friday, before Mr. Justice Chitty, Mr. Farwell, Q.C., appeared on behalf of the Huddersfield Union Banking Company in support of an application for the appointment of a receiver and manager in the matter of Andrews and Preece, Limited, electrical engineers, of Halifax. Learned counsel said the business was a good one, but there was a considerable overdraft at the bank, and it was thought desirable that a receiver and manager should be appointed to protect the interests of the debenture holders. There was no opposition, and his Lordship appointed Mr. James Duff, chartered accountant, of Halifax.

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### An Electrician's Inventions.

At a sitting of the London Bankruptcy Court, held last Tuesday before Mr. Registrar Linklater, Arthur French St. George, electrician, of Marine Street, Bermondsey, and Earlswood, applied to pass his public examination upon accounts showing total liabilities £1,033, and a deficiency of £529. In the course of his evidence the bankrupt stated that he had failed on two previous occasions, viz., in 1883 and again in 1886, when the petition was filed by the United Telephone Company. He did not attend for public examination under the latter proceeding, no notice of the sitting having reached him, and the examination was adjourned *sine die*. Since the bankruptcy of 1886 he had been occupied in perfecting and patenting certain inventions, including an incandescent lamp and an electric light. The lamp was a perfect success and was offered to Woodhouse and Rawson, but owing to the litigation with the Edison & Swan combination, Woodhouse & Rawson were not able to make use of his patent, which was thus rendered valueless. Whilst engaged on those inventions witness was advanced money by his friends, who were content to look for repayment to the success of the inventions. The examination was ordered to be concluded.

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### The Electro-Medical Apparatus Company.

At a sitting of the London Bankruptcy Court held on the 20th inst. before Mr. Registrar Brougham, Alan Kirk, electrical engineer, was allowed to pass his public examination upon accounts showing debts, £328 2s. 2d., and assets, £3 10s. In reply to Mr. E. L. Hough, Official Receiver, the bankrupt stated that he was 24 years of age. He commenced business in July, 1892, when his father purchased on his behalf for £400—one-third share in a business of medical electricians. That £400 was a gift, but later his father lent him £80, by the aid of which he increased his share in the business from one-third to one-half. The trading was carried on under the style of the Electro-Medical Apparatus Company, at St. Martin's Lane, and was continued until September, 1893. By that time the money had come to an end, and the landlord distraining for his rent, the stock was sold off to pay out the execution. The partner, H. N. Lawrence was now believed to be in America. Witness's father held possession of a portion of the stock in consideration of having paid out the execution, and his claim for the loan of £80, for which the firm's I.O.U. was given, but no partnership of any kind had ever been suggested on the father's part. In November, 1893, witness resumed business at Powis Street, Woolwich, and at Leicester Square, both of which places were relinquished last May. Since then he had travelled for an electrical firm on commission. The partnership business was hopelessly insolvent when it was closed, and having regard to the outstanding partnership debts, witness had been insolvent ever since. The examination was concluded.

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### Reconstruction of the Medical Battery Company.

In the Chancery Division of the High Court of Justice on Wednesday, application was made to Mr. Justice Williams to sanction a scheme for the reconstruction of the Medical Battery Company. Counsel said one of the petitioners in this matter was Miss Wilkinson, the plaintiff in the debenture holders' action. The petition asked the Court to sanction an arrangement whereby the assets of the company were to be sold to a new company to be formed for the purpose of carrying on the electrical business. It was proposed to raise a sum of £3,000 by first debentures, the present debentures to take second debentures, the ordinary creditors of the old company to take preference shares, and the shareholders to take ordinary shares in the new company. All parties concerned had agreed to the scheme.

Mr. Justice Williams, said he must be satisfied that the business to be carried on was a proper one, and he only sanctioned the scheme subject to the memorandum of association being altered so as to provide that electric treatment and the sale of electric belts should be controlled by a duly qualified medical attendant.

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## CORRESPONDENCE.

### Re Caustic Soda.

It is true that some remarks of yours in February last had "the effect of bringing forth a letter" from me; but you did not give a satisfactory reply to my question, as to how it happened that you obtained a proof of the prospectus which I, as one of the consulting engineers of the Trust, was not allowed to keep. May I now repeat that question?

I know nothing of the Electro-Chemical Company's affairs. You printed and criticised, about a year ago, a report of mine which had not been published in its entirety—nor quite correctly—and which I subsequently declined to re-write or modify; but I will say no more, because I have recently had to institute legal proceedings in order to recover my fees for services rendered during nearly three years.

**Wm. H. Massey.**

*July 24th*, 1884.

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### The New System of Ship Wiring.

Mr. Mackie's criticism on the letters of your various correspondents on the above subject interested me greatly. I would suggest, however, that that gentleman should not be so hasty in forming opinions as to whether other firms or persons are capable or not of estimating for work by means of which they gain their livelihood.

Considering that I have wired upwards of ten ironclads and cruisers, let alone mercantile vessels, I think, Sir, you will allow that I have, at least, some knowledge on the subject.

I would also remind Mr. Mackie that fitting out ironclads, where often 4-inch and 6-inch plating has to be cut through, is a very different matter from wiring a pleasure steamer which is never at sea more than a day at a time.

Finally, I regret to see that Mr. Mackie is conservative and behind this democratic age in the species of electricity he finds necessary to generate, as he says: "Your correspondents appear to have overlooked the fact that the system of wiring adopted on *La Marguerite* is only satisfactorily worked by a Siemens or Mackie dynamo."

An installation that I fit can actually be run from any constant pressure dynamo, even one of Messrs. Siemens or

my own; in fact, I was not aware that Mr. Mackie was a manufacturer of dynamos.

**Ronald A. Scott.**

*July 23rd*, 1894.

[Not to know that Mr. Mackie has been a dynamo maker of repute for many years past, shows that, at least, one other gentleman is also behind the age.—Eds. Elec. Rev.]

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**Alternate Current Distribution.**

I have read with great interest Mr. Whitcher's letter in your last issue and your note thereon, and fully agree with him that before writing your article you had evidently not been able to give sufficient thought to the subject, which is, undoubtedly, one of surpassing interest, nay, I might go further, and say that it is at the present juncture of vital importance to the industry, and well worthy of the fullest discussion in your valuable journal. I hope Mr. Whitcher will comply with your suggestion and give a fuller explanation of his proposed scheme. I might point out to him that in quoting the No. of Giepel's patent he quoted by mistake one of Lowrie's patents, viz., No. 3,666, of 1893.

**Alfred Thompson.**

*July 18th*, 1894.

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In computing the value to be attached to Lowrie's compound intraposed system I had recourse to the Board of Trade returns for 1893, and enclose pro forma balance-sheet, showing the averages of 29 central stations, which may be of interest to your readers. I can, of course, furnish full details from which this summary is made, if desired for publication.

Electricity Supply Only (High, Extra High, and Low Tensions), 29 Stations' Averages.

| Cr. | | |
|---|---|---|
| 1893, 15,500,000 units at 5·9 ... ... | ... | £381,000 |
| Average price received ... ... | 5·90 | |
| " " cost ... ... ... | 3·78 | |
| " " margin P. & D. ... | 2·12 | |
| Per cent. cost to revenue ... ... | 64·55 | |
| " " " capital ... ... | 5·49 | |
| " " revenue to capital ... | 8·50 | |
| " " on capital for redemption | 3·33 | |
| " " " " deficit ... | 0·32 | |
| Units to the £ capital ... ... | 1·00 | |

| Dr. Costs. Per cent. to capital. | | |
|---|---|---|
| 2·58 Costs low tension ... ... ... | | £116,000 |
| 2·17 " high tension ... ... ... | | 96,450 |
| 0·74 " extra high tension ... ... | | 33,540 |
| 5·49 | | £245,990 |
| Say ... ... | | £246,000 |
| 3·33 Redemption fund at 3·33 per cent. | | 149,400 |
| 8·82 on £4,482,000 ... ... ... ·32 deficit | | 395,400 |
| 8·5 0·32 per cent. deficit ... ... | | 14,400 |
| | | £381,000 |

If redemption fund is reduced to 3 per cent., accounts will balance without deficit.

*June 27th*, 1894.

**Alfred Thompson.**

*July 18th*, 1894.

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As I observe from your foot note at the end of your correspondence columns of last issue that you had not space to insert my last letter, I would like now, after perusing Mr. Whitcher's last communication respecting electrical distribution, to add a few words to it. Firstly, let me take the opportunity of assuring Mr. Whitcher how thoroughly I appreciate the value of his scheme, the details of which I have read in his patent specifications, and that I am looking forward with interest to the publication of his further explanation of it. I may, however, point out to him that while I agree with him that sub-stations and attendance do not form the crux of electrical high tension distribution, because the enormous cost of the secondary mains on such a system nullifies the advantages obtained by it, and that to obtain its fullest advantages it is necessary that the points of connection between the high and low tension mains should be both numerous and well distributed over the district supplied. I go further, and assert that attendants, however watchful, cannot possibly grapple with the contingencies of a variable and extended system of distribution; that each constituent element of the system should not only be controlled from the station, but should be automatically and individually controlled and safeguarded, and not only so, but the system should, as a whole, be safeguarded from the adverse action of any of its parts. It must be obvious that if a system of many units, all working in parallel to a common end, has to wait the discovery by its attendant of any fault that may arise in any one of them, the result to the whole system may be disastrous, as time is the essential factor. To eliminate this time factor the only course open is to actually put into—so that it forms an integral part of the system—an automatic controller, or attendant, able to perform functions that no attendant not inserted in the system can do.

To turn now to a few points in Lowrie's system which Mr. Whitcher has not apparently grasped, I would refer, firstly, to "his fear of extra expenditure and limited control." As a matter of fact, the first cost must necessarily be less, as by subdividing the primary mains all the advantages at present appertaining to duplicate mains are retained, and when the subdivision is carried out in its entirety—as will be necessary to meet the demands of a district—the advantages of duplication will be greatly augmented, while the aggregate cross-section of the copper employed will only be equal to single mains. The subdivided mains will be small in section, cheaply handled and restored, repaired or added to, each section adding to the aggregate of the copper, and a further most important item, they will be practically free from hysteresis losses and capable of being worked up to their fullest carrying capacity, while the control of the converters will be only limited by the number of sub-divisions into which the primary is sub-divided. As to the secondaries, an interposition at the points of demand of converters will enable them to be always used to their fullest capacity without any detrimental variation of potential throughout, thus ensuring economy in first cost, cost of repairs, additions, and working charges.

Secondly.—As to "his fear of the cost and maintenance of the controller switches." The controllers, so far from being complex pieces of mechanism, have only one direct movement of short range. They are an actual part of the converter power doing work on the circuit, and any additional cost which can only be on the switch contacts, is more than covered by the saving in high-tension fuses and terminals which they render unnecessary.

Thirdly.—No tapping arrangements are required, as the power to actuate the switches can be any proportion of the whole available; in fact, if necessary, the entire circuit power might be used in the momentary act of making and breaking them. The action of the controllers does not rely on a sudden momentary rush of current, but in a positive application of force applied until their functions are fulfilled, when it (the powers brought to bear) at once ceases or is diverted into the circuits.

Fourthly.—As to separate control wires and the like, the controllers have no wasteful shunts, no choking coils in series with the supply circuits, and no separate control wires, they consume no energy except at the actual moment of action, and need not in any way be connected with the high tension unless specially desired.

Fifthly.—As to sectioned or sub-divided mains and their origin, these, as can be shown in past publications, are quite public property; but Lowrie is first in the field with a combination of them, and an automatic controller switch in the secondary circuits of transformers that act by mere making or breaking of the section of the primary circuit to which the primary windings of the converters with which they are working in conjunction are attached. The Lowrie controller switch, therefore, thoroughly sub-divides the risks in addition to acting in the capacity of converter and fuse, and allows the converter powers in the circuits to be proportioned to all loads and the use of simple cheap mains that can be added to without disturbing any existing plant.

**Alfred Thompson.**

### London County Council Electric Lighting.

Those who have read the specification of the London County Council for the electric lighting of the Victoria Embankment have no doubt done so with mixed feelings.

To the "moderate" electrical engineer it is the odious offspring of Democracy (with a big D); but even the "progressist" electrician will call aloud on this occasion to be saved from his friends.

All will, I fancy, agree on one point—its objectionable character.

The specification exposes itself to criticism on both technical and general counts.

The technical demands are for plant which, so far as I am aware, differs from anything anyone has made, and suits nobody. So far they bear the stamp of impartiality. But this is a melancholy compensation for the time and expense which manufacturers and contractors will require to devote to the elaboration of schemes and designs to fit the specification—in order that the idiosyncracies of somebody may be satisfied and probably the lowest bidder involved in ultimate loss for his pains. It is the apotheosis of the "expert called in to advise."

The general demands are based on principles long since adopted by the County Council in regard to their contracts: but the particular application of them under consideration strikes one as of peculiar importance by virtually creating a precedent in relation to an industry which has never yet been so peremptorily called upon to bow the knee to Baal. Personally of "progressist" sympathies, and alive to the good features of the more organised Trades Unions which are endowed with some statesmanship in their policies, I object strongly to this barefaced attempt to enforce recognition of unions which are still far from possession of saving grace, and of the moderation of whose views there is no evidence. When I voted "straight" at the last County Council election I did not foresee that the "Progressist" majority would call on the hand that helped it to mount, to paste up schedules of Trades' Union rates of wages, not only in one's own works, but would expect their contractors, under peril of penalties, to insist that all those from whom they might purchase raw or finished materials throughout Christendom should do the same. This demand, of course, means in effect that the successful contractor must resign himself to the employment of trades union hands exclusively in his works, and, whatever his present rates of wages, must forthwith adopt as his standards those which are demanded by unions whose horizon is in some cases bounded at present by a mixture of ill-organisation, inexperience, and simple greed.

The practical point, however, for consideration is: What can or ought the electrical industry to do in the presence of this specification?

The most obvious course is to decline to tender altogether. We can imagine this is what the L. C. Councillor would say: "My dear sir, if you don't like it, you have your remedy—don't tender." But this, I submit, is not a proper course, because, in the first place, a difficulty which must be faced sooner or later, is thus only shelved for the moment; and in the next, the probable result will be that the contract would be placed in the hands of some inexperienced firm who would gladly undertake conditions to which the industry should never be subjected, in order to taste the sweets of self-advertisement and be covered with the glory of contractorship to the London County Council.

The general principles on which the specification is founded were settled at the municipal hustings; and it would be waste of time for electrical manufacturers and contractors to try and force the Council to recant their articles of faith in respect of one particular industry among many. Such a course would be heroic but idle.

But if all parties tendering would do so with certain reservations in respect of the most objectionable features of the specification, it is probable that the useful end would be served, of at once leading to the work being carried out, and by some contractor whose standing would be a guarantee of success; while the ground would be opened for securing, by discussion and some mutual concession, a precedent for the lines of future specifications which may be issued by the London County Council or other municipal authorities of "advanced" views.

The importance of the matter is not to be ignored and is a proper subject for full discussion and consideration by the electrical industry, through the columns of the Press, in Chambers of Commerce, &c. What is wanted is associated action—the ideal for which we all sigh but so often fall short of!

S. P. R.

*July 24th*, 1894.

## A REMARKABLE SPECIFICATION.

London County Council Victoria Embankment, &c., Electric Lighting. Contract and Specification for Engines, Dynamos, &c. (2nd.)

This document is most extraordinary, from the very prominent place given to the Trades' Union exactions. It begins by binding the contractor to Trades' Union hours of labour in paragraph 1; in paragraph 2, it binds him to pay Trades' Union wages; and the next compels him to observe the Trades' Union rules and regulations outside of a 20-mile radius from Charing Cross!! Does the London County Council engage Trades' Unionists to draw up its instructions for tenders? It seems to us as if this were actually the case, for the whole of the instructions refer exclusively to the interests of the Trades' Unions.

Then schedule No. 1 is an elaborately detailed table of wages, and rates for overtime for a great number of trades, which the contractor, under a penalty of £5 for every breach, binds himself to pay. This £5 is to be paid simply on demand by the Council. The contractor is also liable to a fine of 5s. for every hour more than those stipulated by the Trades' Unions worked by any man, and he is to be fined £1 a day for every day during which he neglects to hang up a copy of the table of rates of wages, &c., where it may be easily read by the workmen.

A fine of £3 and another of £10 is imposed on the contractor to compel him to keep properly, and exhibit, on demand, his wages, sheets; these fines and penalties are ingeniously called "liquidated damages," but whatever that may mean in Trades' Union language we do not pretend to know. But perhaps the greatest absurdity is, that in case of any dispute, the County Council's own engineer is to be the sole arbitrator and his decision is to be final.

Who would be a contractor under such a monstrously one-sided contract? The London County Council may draw up its contracts strictly according to Trades' Union rules, and submit to be entirely dominated by that body, but do they expect to find contractors willing to accept such extraordinary responsibilities? The workmen are secured a high rate of wages and limited to short hours, and no doubt the lucky ones who get on to that job will have what is called "a good time"; but how is the contractor to secure value for these wages? No "liquidated damages" are set forth against the workman who may be incompetent, careless, or lazy.

The contractor who would accept such terms must cover himself amply by a high price, so that public money must, in this case, be spent solely to bolster up these arrogant demands.

We venture to say that this contract is the most remarkable one we ever came across, for here we have a public body elected in the interest of the whole community pandering to a class, openly and defiantly imposing the exactions of that class in a public contract. County councils have never gone to the length of fixing rates of wages until now, for this power does not belong to them; they have no right to interfere in such a matter, and if they are allowed thus to arrogantly assume powers never dreamt of by those who created the councils, it will not end at this point. The subject is one which should not be allowed to pass unnoticed; it is a question whether the whole thing is not altogether illegal. The old Metropolitan Board of Works was often accused of corruption; let us hope that this taint does not attach itself to the new body.

## NOTES.

**Electric Light at Dover.**—The preparations for the installation of the electric light into Dover are going on apace, the mains and service boxes having been laid throughout the Marine Parade, New Bridge, Bench Street, Market Square, Biggin Street, and Ladywell, to the station which is being erected there. It is expected that the light will make its first appearance during the latter part of next September.

**Mechanical Traction in Paris.**—It has at length been decided at Paris to consider the question of mechanical traction, and particularly electrical traction. The Municipal Council has at last yielded to the arguments urged on all sides for the establishment of mechanical tramways. It has been decided to send a delegation to study the various systems of traction in use in other countries. This is an important step, for we may rest assured that on the return of the delegates the municipal councillors will authorise the establishment of electrical tramways in Paris, even with overhead trolleys.

**Lighting at Portsmouth.**—We hear the most gratifying reports concerning the working of the Portsmouth system. The lighting of the Esplanade, as well as the streets, is all that could be desired, and the private supply is increasing.

**The Huddersfield Electrical Engineer.**—Mr. A. B. Mountain, who in December, 1891, was appointed to superintend the erection of the lighting plant at £200 a year, has been permanently appointed borough electrical engineer and manager, at a salary of £250 a year.

**The Opening of Hanley Electrical Works.**—It is really becoming a difficult matter to keep pace with the new stations that are being opened. The Hanley Municipal Works was formally started on its career last night by His Worship the Mayor. We wish it all success.

**Société des Electriciens.**—At the commencement of the sitting of July 4th, M. Postel-Vinay announced the death of M. P. Lemonnier, formerly president of the Society, and spoke a few words in his memory. M. L. Brunswick then made a short speech on the subject of the Antwerp Exhibition. He only gave a very few general details, and hinted that the electrical applications were not very numerous. He mentioned some types of continuous current dynamos, in particular the machines constructed by the firms of Dulait and Pieper. The first exhibited two groups of two machines of 1,200 ampères and 260 volts, and the second two compound dynamos of 80 kilowatts, at a difference of potential of 550 volts and at 550 turns per minute. The firm of Schückert, of Nuremberg, has installed a projector, the mirror of which is 1·50 metres in diameter, and which is to be used later at the Antwerp Museum. The current for this projector is 150 ampères. The power expended for the whole of the lighting of the Exhibition is 400 kilowatts. Amongst the various applications M. Brunswick quotes a balloon which is to be propelled by triphased current motors, and which is to convey passengers from the Place d'Anvers to the Exhibition; it is not yet at work. On quitting Antwerp, M. Brunswick visited the Electro-Technical Institute of Liège, Herstal's manufactory of arms, the workshops of Messrs. Jaspar, Pieper, &c. He also spoke of the electrical tramways of Brussels.

**The Trials of an Editor.**—We are frequently asked for advice on almost every conceivable topic, and scarcely a day passes without some of our time being devoted to replying to questions of real utility, or to others which are more or less the creations of some victim to mental aberration. Rarely, however, have we had a larger order than that contained in the following letter, which reached us the other day from Cape Colony, and is reproduced below :—

Gentlemen,—I take the liberty of writing these few lines, asking you if you would kindly give me your valuable assistance in helping me to solve this problem, and give me your opinion on the matter. As you are well aware, Kimberley is a mining town, and within the mining area there are tons—I might say hundreds of tons—of old iron and wire rope. My idea is to buy this and cut it up and melt it and re-draw it into wire again (not rope, just ordinary iron wire of different sizes). I prefer electricity, and would you be kind enough to let me know what you would think would be a fair price to offer for the old iron and rope after paying, say, 10 per cent. for railway and carriage, and after paying wages and expenses, and say 5 per cent. interest on the capital, and about what do you think the plant will cost, and how many would be required to work it, taking wages about the same as in England, and land and water is very cheap here, you might say (*nil*) for water, and coal, say, £1 to 25s. to bring the wire about the same price as in England, or about. I do not expect everything exact, but if it can be done by electricity, and cheap by electricity, the question is can it be done by electricity, if it can, how, and what kind of furnace should I require, and what machinery to re-draw it, and what power would be required to drive the whole plant, say to deal with about 1 cwt. at a time? Of course, you will understand, gentlemen, it is only an experiment, and if it will pay I can alway[illegible]largen it afterwards. I write to you knowing the experience you have in all things electrical. If it cannot be done by electricity, what would a plant cost to do it with gas, although the coal in this country is not up to much for producing gas, but I should think there's money to be made at it. I would feel very much obliged if you would kindly forward me a rough sketch, not a proper drawing, just a rough sketch. Of course, I can always add machinery for making screws and nails and such like, but that is an after consideration, and where would you recommend me to buy the machinery and dynamo or alternator? I forward you directed envelope and postage. Hoping you will do your best, and oblige me if it lays in your power, and an early reply will greatly oblige.

**Telephonic Communication in Switzerland.**—A Bill is at present engaging the attention of the Swiss Parliament, by which it is proposed to considerably modify the annual subscriptions to the urban telephone system in Switzerland.

**Electric Lighthouses in France.**—It has been decided to equip the lighthouse on the Island of Yeu, in the Bay of Biscay, with a powerful electric light, flashing every five seconds. The light will be capable of being seen, in clear weather, within a radius of 52 miles.

**Fatal Accident in the Sector of the Champs-Elysées.**—On the 5th inst. a workman belonging to the Sector of the Champs-Elysées, appointed to visit the posts where the transformers are stationed for supplying consumers, accidentally touched the primary cables at the post of No. 44, Avenue des Champs-Elysées, and was struck senseless, dying a few hours after. The workman was quite accustomed to this work; he had no manipulations to perform, but simply to ascertain whether everything was in good order and report upon it.

**Smoke in Paris.**—Several complaints have been made lately against the electrical works of Paris, with regard to the quantities of smoke that they send out. The Municipal Council has taken up the question, and has just appointed a technical committee to examine the various smoke-consuming apparatus known. A competition will be arranged, and the apparatus considered satisfactory will be subjected to several lengthy tests. After these trials prizes of 10,000, 5,000, and 2,000 francs will be awarded to those apparatus that have given the best results.

**The Teleautograph.**—By permission of the postal authorities the four telephone wires between St. Margaret's Bay and the General Post Office, London, were, on Sunday afternoon and evening, used for the purpose of some experiments with the Gray teleautograph, the time for the experiments being selected owing to the wires being comparatively idle on Sundays. The experiments took place between the General Post Office, London, and the Cable Hut, St. Margaret's Bay, through which the London and Paris telephone wires pass. Instruments were connected up at both ends, and the results were excellent, the messages transmitted being in every respect most successful, the apparatus working without the slightest hitch over the distance of 83 miles. Messages were both sent from and received at St. Margaret's Bay.

**Some Subsidiary Uses of Corporation Electric Supplies.**—In the current number of the *Memoirs and Proceedings* of the Manchester Literary and Philosophical Society, the most interesting feature is an account of an address by Mr. Henry Wilde, F.R.S., who reviewed the progress of dynamo machinery since the year 1866, when he invited the Council of the Society to a private demonstration of the powers of a new generator of electricity, founded on his discovery of the principle "that quantities of magnetism and electricity indefinitely small could induce quantities of these forces indefinitely great." In illustration of the degree of progress which has now been obtained, Mr. Wilde gave an experimental demonstration of the uses to which the Corporation supply of electric light and power may be put in philosophical research. Of the many uses and manifestations of the electric supply, the following may be enumerated :—1. The arc and incandescent lights. 2. Heating wires, and other calorific phenomena. 3. Energising induction coils and producing electric oscillations. 4. Charging powerful electro-magnets. 5. The action of magnetism on gases. 6. Dia-magnetic polarity and magne-crystallic force. 7. Reproducing the phenomena of terrestrial magnetism. 8. Demonstrations in spectrum analysis. 9. Conversion of electricity into mechanical work. 10. Electrolysis of chemical compounds. 11. Reduction of refractory substances in the electric furnace. 12. Artificial formation of minerals. 13. Demonstrations in biology and physiology. 14. Lantern projections for microscopic and other objects. Mr. Wilde dwelt on the facilities thus afforded by the Corporation electric supply for prosecuting original research, and held that the substitution of electric light for gas in the Society's rooms was not of greater interest than the facilities now afforded by the Corporation supply of electricity for increasing the light of natural knowledge.

**The Electric Locomotives on the City Railway.**—Experiments are being made on the City and South London Railway with a view to substituting motors on the train itself in place of the present separate locomotive, with the object of adding an additional coach to each train.

**Kingston Regatta.** — This annual fixture took place on Wednesday last in the most favourable weather, the sun shining brightly all day. The Town Hall was lighted up by electricity, the current being supplied fromthe Corporation electric lighting works, and the front of the civic headquarters being covered with about 750 incandescent lamps of 8 and 16-candle-power.

**The Living Wage.**—The letter from Mr. Menzies in our issue of the 13th inst. has had the effect of saving one individual from being victimised. The young man in search of "the living wage" was pleased to accept the quotation of Mr. W. Mackie for 12 dynamos at £350 each, his bankers being prepared to pay one-third on presentation of *pro forma* account, and the remaining two-thirds on B/L. Mr. Mackie took the precaution to go to the bank early the following morning, and was informed that all they desired was to come across that young man of the Wellington Exhibition Syndicate.

**A Novel Method of Testing Thermometers.**—During the last few years the Owens College has undertaken the testing of clinical and other thermometers, and in carrying out this work they make use of the following ingenious electrical arrangement, whereby a number of thermometers can be tested simultaneously:—The apparatus consists of two cylindrical vessels, one placed within the other. Both are filled with water. The thermometers are placed in a carrier inside the inner vessel. The water in the outer vessel is maintained at any desired temperature by an electric current passing through platinum wires immersed in the water, but insulated by means of India-rubber tubes from the sides of the vessel. The water in the inner vessel is kept stirred by means of a revolving screw turned by an electric motor. The thermometers are compared at various temperatures and then adjusted. This electrical apparatus was adopted because by means of it it was possible to obtain very much greater accuracy both in manipulating and in adjusting the temperatures.

**The Magnetic Properties of some Iron-Nickel Alloys.**—Mons. F. Osmond, whose researches in metallurgy have become almost as classical as those of Percy and Roberts-Austen, has recently examined a series of alloys formed from iron and nickel, which had been prepared by R. A. Hadfield. His results were communicated to the Paris Academy of Science (*vide Comptes Rendus*, cxviii., pp. 532—534). The series had the following composition :—

| Alloy. | Carbon. | Silicon. | Manganese. | Nickel. |
|---|---|---|---|---|
| A | 0·19 | 0·31 | 0 79 | 0·27 |
| C | 0 13 | 0·23 | 0·72 | 0·94 |
| E | 0·19 | 0·20 | 0 65 | 3 82 |
| G | 0·17 | 0·28 | 0 68 | 7·65 |
| J | 0·23 | 0 24 | 0 93 | 15 48 |
| K | 0 19 | 0·27 | 0 93 | 19 64 |
| L | 0 16 | 0 30 | 1·00 | 24 51 |
| M | 0 14 | 0·38 | 0·86 | 29 07 |
| N | 0·16 | 0·31 | 1 08 | 49 65 |

In these compositions the percentage of iron is not stated; it can, of course, be calculated by difference.

All the alloys from A to L were found to be strongly magnetic, this property being somewhat less marked with the alloys, K, L. The alloy M was almost non-magnetic, especially when examined at a temperature of 70° C.; whilst N showed a slight degree of magnetism, which is probably accounted for by the presence of an excess of nickel. The alloys, J, K, and L, were markedly magnetipolar. L became non-magnetic when its temperature was raised, so long as it did not cool again below 50° C.; between 50° and 0° C. it became magnetic, but lost this property on again being heated to redness. The hardness of the alloys, J, K, and L was greatly increased during cooling, as the molecular rearrangement progressed; and the magnetic polarity appeared to change simultaneously with the degree of hardness. This Osmond considers to be due to incomplete transformation.

**Expert Modesty.**—Unexpected modesty was developed by an expert witness in the Cassell Gold case, which we report in this issue. Prof. Dewar, F.R.S., on being asked what were his qualifications, replied, with humility, that he had a fair knowledge of chemistry.

**Interior Wiring on the Five-Wire System.**—When we said that the Manchester Town Hall was the only building wired on the five-wire system, we had overlooked the fact that the Royal Exchange, the Free Trade Hall, and the Free Reference Library, Manchester, had been wired by Messrs. Verity on this system.

**The New City and Waterloo Electric Line.**—Much curiosity is evinced respecting the extensive pile-driving now in progress on the south side of the river near Blackfriars Bridge. Not many persons, apart from special information, would suppose this to be the way to commence a new underground railway. That, however, is the object of the work, and this pile-driving is the practical commencement of the new City and Waterloo electric line.

## NEW COMPANIES REGISTERED.

**John Mills & Sons, Limited** (41,611).—This company was registered on the 18th inst. with a capital of £25,000, in 500 £10 preference, and 2,000 £10 ordinary shares, to acquire and carry on the business of W. J. H. Ryder, now carried on at Newcastle-on-Tyne, Walker Gate, and elsewhere, under the style of John Mills & Sons, and to continue the trades of brassfounders and finishers, coppersmiths, metallurgists, electricians, and electrical and mechanical engineers. The subscribers (with one share each) are:—E. Mills, 52, Jesmond Road, Newcastle-on-Tyne, spinster; W. J. H. Ryder, 4, Graingeville, Newcastle-on-Tyne; J. N. Guy, 21, Lansdowne Terrace, Newcastle-on-Tyne; C. A. MacEacharn, 28, Simonside Terrace, Heaton, Newcastle-on-Tyne, accountant; J. F. Blackett, 6, Windsor Crescent, Newcastle-on-Tyne, electrician; A. Ryder, Newcastle-on-Tyne, widow; J. C. Brumwell, 77, Stanton Street, Newcastle-on-Tyne, clerk. The first directors are Messrs. W. J. H. Ryder, J. N. Guy, C. A. MacEacharn, and J. F. Blackett; qualification, 40 shares. Registered by Waterlow Bros. & Layton, Limited, 24-5 Birchin Lane, E.C.

**British and Foreign Electric and Engineering Company, Limited** (41,639).—This company was registered on the 23rd inst. with a capital of £2,000, in 1,950 ordinary and 50 founders' shares of £1 each, to carry on the manufacture and sale of electric, telegraphic, surgical and scientific instruments, and also the business of electrical engineers. The subscribers (with 1 share each) are: H. E. Hopperton, 10, Holmsdale Road, Bromley, gentleman; A. W. Hussey, Ormonde House, Trafalgar Road, S.E., engineer; S. W. Kelsey, 2, Lancaster Street, W., gentleman; F. Cottrell, 13, Ellesmere Villas, Wimbledon, shipper; W. R. Reeve, Ormonde House, S.E., merchant. Until otherwise determined, the above-named subscribers are to be the first directors of the company; qualification, 100 shares; remuneration, £1,000 per annum. Registered by J. A. Remon, St. Dunstan's Chambers, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Western and Brazilian Telegraph Company, Limited** (7,251 C).—This company's annual return has recently been filed. It shows that out of a nominal capital of £1,500,000 in 66,871 £15, and 66,258 £7 10s. shares, 64,242 £15, and the whole of the latter shares have been taken up. The full amount has been called, and the total received in response thereto is £1,460,565. The sum of £565 has been paid on 75 shares forfeited.

**Dalziel's Atlantic Telegraph Company, Limited** (37,868).—The annual return of this company, made up to May 14th last, was filed at Somerset House on the 10th inst. It shows that out of a nominal capital of £25,000, in £100 shares, 228 shares have been taken up, 150 of which have been issued as fully paid. The full amount has been called on 1 share, and calls of £63 per share have been made on 77 shares. The result is £4,719. There is £232 outstanding.

**West India and Panama Telegraph Co., Limited** (11,116).—The annual return of this company has lately been filed. It shows that out of a nominal capital of £2,445,630 in 200,000 ordinary, 34,563 first preference, and £10,000 second preference shares all of £10 each, 88,321 ordinary, the whole of the first preference, and 4,669 of the second preference have been taken up. The full amount has been called, and £1,275,530 paid.

## BUSINESS NOTICES, &c.

**Guide Book or Catalogue.**—There are guide books that might well be catalogued as catalogues, and catalogues that rise to the dignity of guide books. In the latter class we may fairly include a book which has been recently issued, in English, by the Allgemeine Elektricitäts Gesellschaft. We spoke of the general merits of the work upon receiving the German edition some weeks ago, but we are now able to see the scope of the book, and, but for its size, it might be placed in the pocket along with Munro and Jamieson's Pocket-book, and other manuals which are designed for the pocket, but the weight of which will make an ordinary table groan. It aims, with success, we think, to be something more than a price list. True we have the prices of the firm's manufactures clearly given, but we have also descriptions of apparatus and information provided with regard to erecting and using electric light plant, which would be useful to the user of all types of machines. With this guide a novice might set up business as consulting engineer, and, provided that he gave contracts to the right people, he would be an assured success. A complete treatise on how to estimate for two 2-C.P. lamps up to two or three hundred lights is included, as well as hints on power transmission, with interesting drawings and useful information concerning the use of motors. All these and much more is to be found in this well-printed and excellently arranged manual. We might add that the publishers of the Electrical Review have made arrangements with the Allgemeine Elektricitäts Gesellschaft for the sale of English copies. The Electrical Company, as agents for the German company, have sent us a similar copy.

**Hampstead Electric Lighting.**—The Vestry have adopted the following scale of reductions, as prepared by Mr. Preece, in the bills for electric current supplied to private consumers in this parish:—

| Annual bill, £. | Proposed reduction. | No. of units metered. | Nett cost per unit. |
|---|---|---|---|
| 25 | 3 per cent. | 1,000 | 5·82 pence. |
| 50 | 5 „ „ | 2,000 | 3·7 „ |
| 100 | 10 „ „ | 4,000 | 5·4 „ |
| 250 | 15 „ „ | 10,000 | 5·1 „ |
| 500 and over | 20 „ „ | 20,000 | 4·8 „ |

Another recommendation, that the charge to private consumers for electric current during light and day loads (ranging from midnight to sunset), be fourpence per unit, the charge for the night service remaining at 6d. per unit, was referred back for further consideration and report.

**Incubation by Electricity at St. Helens.**—At St. Helens County Court, before Judge Shand, last week, the Abel Electrical Engineering Company claimed £2 17s. 6d. from Robert Pownall, watchmaker, Westfield Street, alleged to be due for electrical apparatus supplied. Mr. Chas. Cook appeared for the plaintiffs. It appeared that the defendant was the tenant of a farm at Sutton, and conceived the idea of working his fowl incubators by electricity. He consulted the manager of the Abel Electrical Company upon the matter, and at his request certain apparatus was supplied. The defendant afterwards alleged that the apparatus would not work, and refused to pay the account. He contended that the machine was a failure owing to bad workmanship, and said it had ruined 600 eggs, for which he had paid a considerable sum. In reply to questions by his honour, it was stated that the plaintiff company was now in liquidation. The official liquidator had not instituted the proceedings, and the judge entered a nonsuit.

**Andrews & Preece, Limited.**—Before Mr. Justice Chitty, in the Chancery Division last Friday, the Halifax and Huddersfield Union Banking Company applied for the appointment of a receiver and manager for Andrews & Preece, Limited, of which company they were debenture holders, and which carried on electrical business in Bradford. Mr. James Duff, accountant, Halifax, was by consent appointed receiver and manager. It was stated that the defendant company are holders of several valuable contracts.

**Electric Lighting at Ealing.**—The buildings of the Local Board's central electric lighting station at Ealing, which are being erected to the design and under the superintendence of Messrs. Bramwell & Harris, of 5, Great George Street, Westminster, are approaching completion. The contractors for the buildings are Messrs. Wilkinson Brothers. The machinery and boiler contracts are held by Messrs. Siemens Brothers, and by Messrs. James Watt & Co., respectively, while the mains are being laid by the Callender Bitumen Company. All branches of the work are now so far advanced that the supply of current will be commenced early in September, and the official opening day has been fixed for the 29th of that month. During the month of October, the Local Board propose to hold an electrical exhibition in the Victoria Hall or other suitable place, so that customers may have an opportunity of seeing the uses to which electricity could be put, for lighting or for other purposes.

**Fareham Ratepayers.**—We have already mentioned that many of the Fareham ratepayers objected to the Local Board buying the Electric Light Company's business. A mass meeting was held the other day, when Mr. Smith, a ratepayer, presumably, moved a resolution that the action of the Board was premature. He supported the resolution by calling the Local Board strong names; Mr. Blake followed on the other side, but a quotation from the local newspaper will show the amount of feeling imported into the question:—"A painful scene here took place between Mr. Blake and Mr. Smith. Mutual recriminations followed thick and fast, the parties to the dispute giving each other the lie direct across the table amid considerable uproar—hoots, hisses, applause, laughter, and cries of encouragement. Order having at last been restored, the resolution was put, and the Chairman declared it carried by an overwhelming majority."

**Coal-pit Lighting.**—Mr. Immisch's Company, the Acme and Immisch Electric Works, Limited, Chalk Farm, are installing a complete plant for the Victoria Coal and Coke Company, at their Park Hill collieries. An Immisch Improved colliery dynamo, driven by a vertical engine supplies current for ten 200-C.P. lamps in the yard, with 16 C.P. lamps in the surface buildings, main shaft, and bottom workings; equivalent altogether to 520 16-C.P. lamps. The main cable is carried down the shaft 350 yards deep, and is of special construction; it has an insulation resistance of 3,000 megohms per mile, and is armoured with two layers of stout steel wire. We learn that the company is now thoroughly settled in their new works at Ferdinand Street, Chalk Farm Road, and besides being engaged on several colliery plants, they are busy with numerous dynamos and motors for hoists and various industrial purposes.

**Action Against the Chatham and Rochester Electric Lighting Company.**—George Pepper, late secretary to the Rochester, Chatham and District Electric Lighting Company, brought an action against the company at the Rochester County Court, on Tuesday, last week, before his Honour Judge W. L. Selfe, for the recovery of £10 6s. for commission on obtaining orders for the supply of 206 electric lamp lights in accordance with the Board's minute of May 3rd, 1893. There was a counter-claim for £11 14s. for moneys unaccounted for. The company denied that some of the orders for which plaintiff claimed commission were obtained by him. The counter-claim chiefly arose through the new secretary being unable to understand the books. In the end his Honour gave judgment for plaintiff, £6 8s. on the claim, and for defendant for £2 12s. 5d. on the counter-claim.

**The Lighting of Ayr.**—The Electric Lighting Committee of the Burgh of Ayr have decided to place the contracts for the plant required for their new electricity works with the undermentioned firms:—

| | |
|---|---|
| Penman & Co.—Boiler-house plant ... ... ... ... | £1,541 |
| Siemens Bros. & Co., Limited—Engine-house plant ... | 5,940 |
| John Fowler & Co. (Leeds), Limited—Switchboard ... | 437 |
| Callender's Bitumen Co., Limited—Cables and culverts | 1,842 |
| Swinburne & Co., Limited—Transformers and boxes ... | 420 |
| John Fowler & Co. (Leeds), Limited—Arc lamps and posts | 476 |
| S. Z. de Ferranti, Limited—Meters ... ... ... | 590 |
| Carrick & Ritchie—Overhead crane ... ... ... | 192 |

**The Electric Light at Yester House.**—Yester House, the seat of the Marquis of Tweeddale, is being fitted throughout with the electric light, water-power furnishing the energy necessary to drive the dynamo. The latter will be situated at the Mains, about half a mile distant from the mansion, to which connection will be made by means of an underground cable. There will be a battery of accumulators for maintaining the lights when the dynamo is not running, and altogether some 300 incandescent lamps will be employed. The installation is being arranged by Messrs. A. A. C. Swinton & Co.

**Messrs. Drake & Gorham.**—The reconstruction, rewiring, and extension to the basement, of the electric light at 49, Kensington Court, has been entrusted to Messrs. Drake & Gorham, by Mr. Bruno Schroder. It will be remembered that this firm also carried out the lighting of Baron Schroder's house at the Dell, and Baron von Schroder at the Rookery. The lighting of Bexhill Church has also been placed in their hands by means of a separate plant comprising a Crossley gas engine, E C C dynamo and D P battery; number of lights about 50.

**Outing.**—Messrs. Frank Suter & Co. held their annual outing last Saturday at the Dolphin Hotel, Slough. The party drove down in four-horse brakes, and an excellent dinner was served, at which the toasts of "The Firm," "The Visitors," "The Employés," &c., were proposed and enthusiastically responded to. The afternoon was occupied with sports. About nine o'clock the party drove back to town, having all spent a most enjoyable time.

**Lighting the Army and Navy Stores.**—The contract for the lighting of the Coburg Row and Francis Street depôts of the Army and Navy Stores has been entrusted to Messrs. R. E. Crompton and Co., the work being carried out to the specification and drawings of Mr. Bernard Drake. Messrs. Crompton's tender was the lowest among the firms nominated by the Army and Navy Stores directors, the tenders being in most cases very close.

**Mill Lighting.**—Messrs. Bennett & Druce, of Preston, have received instructions from Mr. Edward Barlow, of Radcliffe, for a complete installation of electric light in his mills. The plant will consist of dynamo driven off the main mill engine, and about 300 incandescent lamps. This firm are also installing a gas engine and dynamo plant for 250 lights in the Preston Industrial Co-operative Society's premises.

**Presentation to Mr. Burbey.**—Last Friday the presentation of a handsome timepiece was made to Mr. Burbey by the employés of the firm of Messrs. Burbey, Williamson & Joseph, on the occasion of his leaving the firm. Mr. Burbey being very popular with the employés, much enthusiasm prevailed, and the expression of good wishes for his future success were unanimous.

**The Kensington and Knightsbridge Electric Lighting.**—We are informed that the fifth annual outing of the employés of the Kensington and Knightsbridge Electric Lighting Company, Limited, was held on Saturday last, the party journeyed to Ramsgate and dinner was taken at Crampton's Hotel, Mr. H. W. Miller presiding.

**Electric Light for Bournemouth Winter Garden.**—An estimate from the surveyor, of the cost of plant, &c., for lighting the Winter Garden with electricity, was submitted at a meeting of the Bournemouth Town Council last week, and a recommendation to apply for sanction to borrow £500 for the purpose was adopted.

**Personal.**—Mr. George Davis, who has been with the St. James's and Pall Mall Electric Light Company as Inspector since its formation in 1889, is leaving the company to act for Messrs. F. Gabriel and H. Angenault as manager of their London business at Connaught Mansions, Victoria Street.

**Electric Light at Brighouse.**—In the paragraph in our issue of the 6th, under this heading, we ought to have stated that the gas engines employed by Mr. Brook for his central station are by Crossley Brothers, as well as the gas engine for the electric light at the Brighouse Co-operative Society.

**Flour Mill Lighting.**—Mr. Wilson Hartnell, of Leeds, has lighted extensive flour mills at Norwood Bridge for Mr. Alfred Robinson. About 100 16-C.P. lamps are used in the mill. Mr. Robinson's house at the rear is lighted, and high candle-power lamps are used outside.

**Tampering with Railway Reading Lamp**—Ernest Lawrence, a carriage cleaner in the employ of the District Railway Company, has been sent to prison for two months for tampering with the electric reading lamps used on the District Railway.

**Suggested Extensions at Hull.**—The Borough Electrical Engineer has informed the Council that the demand for light will soon exceed the supply, and suggests that engines should be laid down at an estimated cost of £4,500.

**Admiralty Contracts.**—The Lords of the Admiralty have awarded the contract for the supply of "Victor" metallic joints, and other asbestos goods, for use in Her Majesty's Navy, to the United Asbestos Company, Limited.

**The Derby Station.**—We omitted to say in our last issue that the excellent photographs of the interior of the Derby station, the switchboard, and the street lamp, were taken by Mr Winter, Midland Road, Derby.

**Factory Lighting**—Messrs. F. W. Ball & Co. have secured the contract for lighting the factory of Messrs. Mardon, Son, and Hall, of Temple Gate, Bristol, with 455 lamps of various candle-power.

**A Loan for Islington Works.**—The Vestry are applying to the County Council for a loan of £51,000, the balance of £60,000, for the purpose of completing the electric lighting works.

**A Company Wanted at Maidstone.**—The Maidstone Electric Light Committee cannot arrange the transfer of the provisional order to the E.C.C., so they are open to offers.

**The Lighting of Eccles.**—The Electric Lighting Committee of Eccles are visiting Whitehaven to obtain information on lighting the streets by electricity.

**Indestructible Ignition Tubes.**—A large reduction is announced in the price of these indispensable gas engine requisites.

**Bath Extensions Opposed.**—The Town Council will oppose the Electric Lighting Company's proposed extensions.

**The Bath Company's Outing.**—The annual outing of the Bath Electric Supply Company was held last Thursday.

**The Harrow Lighting Bill.**—The bill confirming the Provisional Order has passed both Houses of Parliament.

**Church Lighting.**—St. Martin's Church, Scarborough, is to be lighted by electricity.

**Railway Station Lighting.**—Stoke station is being lighted by electricity.

## CONTRACTS OPEN AND CLOSED.

OPEN.

**Nelson.**—July 30th. Persons desirous of tendering for the wiring and fittings in connection with the New Technical School, may obtain plans and particulars (on payment of £1 1s., which will be returned on receipt of a *bonâ fide* tender) by applying to Messrs. Holtom & Fox, architects, Dewsbury. Tenders, endorsed "Electric Light," to be sent to Mr. R. M. Prescott, Town Clerk, Town Hall, Nelson, on or before Monday, July 30th.

CLOSED.

**The Borough of Ayr.**—Full particulars of the tenders for Ayr will be found in our "Notes" columns.

## CITY NOTES.

### The Globe Telegraph and Trust Company, Limited.

The report of the directors states that the net revenue of the company for the year, after deduction of expenses, amounts to £185,076 13s. 9d. and makes, with the balance of £1,304 17s. 9d. brought forward, a total of £186,381 11s. 6d. From this amount there has been distributed the sum of £125,955 16s. 1d. in interim dividends, leaving an available balance of £60,425 15s. 5d.

The directors recommend the payment of a final dividend for the year of 3s. per share on the preference shares, and of 3s. 9d. per share on the ordinary shares, making, with the previous distributions, a total dividend for the year of 6 per cent., less income tax, upon the preference, and 4½ per cent. nett (against 4⅝ per cent. for the preceding year) upon the ordinary shares, and carrying forward a balance of £527 2s. 4d.

The £62,000 6 per cent. debentures of the Direct Spanish Telegraph Company which were held by this company, matured on May 1st last, and were paid off; part of this money, viz., £16,989 1s. 9d., has already been invested as follows:—300 shares in the Western Union Telegraph Company, 250 shares in the American Cable Company, 22 certificates in the Submarine Cables Trust, 354 ordinary shares in the Direct Spanish Telegraph Company, 346 preference shares in the Direct Spanish Telegraph Company. The remainder will be re-invested in suitable securities.

In conformity with the articles of association, Lord Sackville A. Cecil and the Marquis of Tweeddale, two of the directors, retire, and being eligible, offer themselves for re-election. The auditors, Messrs. Deloitte, Dever, Griffiths & Co., and Mr. William Griffith, B.A., barrister-at-law, also retire, and offer themselves for re-election.

### City and South London Railway Company.

The report of the directors for the half-year ending June 30th, 1894, states that the receipts from all sources for the past half-year have amounted to £24,294 17s. 6d., and the cost of working has been £14,990 3s. 2d., leaving a profit of £9,304 14s. 4d. Inclusive of the balance brought forward from December 31st last, the net revenue account shows an aggregate total of £10,368 8s. 2d. After making provision for the debenture and debenture stock interest, a balance remains available for dividend of £6,295 17s. 10d. Out of this sum your directors recommend that the full dividend of 5 per cent. per annum be paid on the preference shares, and that a dividend at the rate of 1 per cent. per annum be paid upon the consolidated ordinary stock, leaving a balance of £1,335 17s. 10d. to be carried forward to the next account. The following table shows the number of passengers, exclusive of season ticket holders, carried since the opening of the railway in each half-year:

| Half-year ended | Number of passengers (exclusive of season ticket holders). | Receipts (including season tickets). |
|---|---|---|
| | | £ s. d. |
| December 31st, 1890 (11 days) | 165,000 | 1,568 3 9 |
| June 30th, 1891 ... ... ... | 2,412,343 | 19,403 6 9 |
| December 31st, 1891 ... ... | 2,749,055 | 19,798 16 6 |
| June 30th, 1892 ... ... ... | 2,813,162 | 20,931 4 2 |
| December 31st, 1892 ... ... | 3,117,602 | 22,002 17 5 |
| June 30th, 1893 ... ... ... | 3,146,656 | 22,458 6 9 |
| December 31st, 1893 ... ... | 3,093,351 | 22,067 14 10 |
| June 30th, 1894 ... ... ... | 3,383,154 | 23,564 10 6 |
| Total since opening of line | 20,880,323 | £151,795 0 8 |

The directors have great satisfaction in stating that the increased traffic has been carried punctually, and free from accident of any kind. The closing of the Oval for football militated against the traffic for the first three months of the half-year, but subsequently there has been a satisfactory increase. The actual cost of working the line for the past half-year has been somewhat less than for the corresponding period last year, but the directors regret that the local rates again show a marked increase. The locomotives, rolling stock,

generating and other plant, have been maintained in thorough working order and repair, as certified by the engineer. The alterations at the City Terminus are complete, and the additional accommodation thus obtained is a great convenience, especially on occasions when the traffic is heavy. The parcels office and left luggage room are in operation, and promise to be a remunerative source of revenue. During the half-year £8,200 of the terminable mortgage debenture bonds have been paid off and re-issued as debenture stock, or preference shares, at a premium. The directors have instructed their engineer to make experiments with the view of substituting motors on the train itself in place of the present separate locomotive, with the object of adding an additional coach to each train. Should this change prove practicable, the number of passengers capable of being carried will be considerably augmented.

## Direct United States Cable Company.

The thirty-fourth ordinary general meeting of the shareholders of this company was held on Tuesday at Winchester House, Old Broad Street, Sir John Pender, M.P., in the chair.

The Chairman, in moving the adoption of the report, after going through the various items in the accounts, showing in detail how the saving in expenses had been brought about, said that the investments had increased during the half-year by £12,057, and they now amounted, taken at cost, to £246,209. The present market value showed an increase of about 13 per cent. over the cost. At the last meeting he said that the prospects were not particularly bright. They were then passing through the most severe crisis that had ever taken place in the United States, and he was sorry to say that the same state of things prevailed to-day; but their experience told them that after a storm came a calm, and after that brighter times. No doubt that would be their experience of the Atlantic system. No doubt directly trade moved there would be an increase of traffic. He was sorry to say, however, that, while they had been preparing to meet increased traffic, the cables were in excess of the requirements. One cable had been completed by the Commercial Company, and another was about to be completed by the Anglo-American Company. There were rumours, too, of another French cable, and a German cable. At present they were only rumours, but when he knew anything about those proposals he would tell the shareholders what he thought was likely to arise from the competition. They had finished the suit in Paris—at all events, there had been a decision which was said to be favourable; but where the favour was he could not discover, as he did not see that they would get anything in return for the large amount of money they had spent upon the case. The general working of their system had been satisfactory. They had had a small breakdown in Halifax Harbour, which, however, was cleverly repaired by their manager there, assisted by some members of the Royal Engineers, to whom he tendered his thanks. Upon the whole, the half-year's working had been satisfactory in every respect except in relation to their earning power, but that was entirely attributable to the depression which existed, not only in America, but over the whole commercial world.

Mr. E. M. Henderson, Q.C., seconded the motion, which was adopted.

The retiring directors (Sir John Pender, M.P., and Mr. James Pender) were re-elected, as were also the retiring auditors, after which the meeting closed with a vote of thanks to the chairman and directors.

## Anglo-American Telegraph Company, Limited.

The report of the directors to be presented to the ordinary general half-yearly meeting of the proprietors, to be held at Cannon Street Hotel, E.C., to-day at 2 o'clock, p.m., states that the total receipts from January 1st to June 30th, 1894, including the balance of £844 2s. 4d. brought forward from the last account, amounted to £135,390 3s. 11d. This sum, however, is subject to revision, as the financial result of the judgment given in favour of this company against the Paris and New York Telegraph Company cannot yet be estimated. The traffic receipts show a decrease of £16,791, as compared with the corresponding period of last year. The total expenses of the half-year, including the repair of cables, &c., as shown by the revenue account, amounted to £55,716 15s. 6d., being a decrease of £4,465 17s. 8d. The directors, under the powers conferred upon them by the articles of association, have, before declaring the net profits, set apart the sum of £12,000 to the renewal fund, leaving a balance of £67,673 8s. 5d. One quarterly interim dividend of 9s. per cent. on the ordinary stock, and of 18s. per cent. on the preferred stock, was paid on May 1st, 1894, absorbing £31,500, and a second quarterly dividend of 10s. per cent. on the ordinary stock, and £1 per cent. on the preferred stock, amounting to £35,000, will be paid on August 1st, 1894, leaving a balance of £1,173 8s. 5d. to be carried forward to the next account. The company's repairing ss. *Minia* has been employed during the past half-year by the Western Union Telegraph Company for the repair of cables belonging to that company, the payments for which appear in the revenue account. She is at present engaged in the repair of the 1874 cable, broken on July 9th last year, 575 miles from Heart's Content. The new cable between Ireland and Newfoundland is in process of being laid. The appeal in the proceedings between the Anglo Company and the Paris and New York Telegraph Company was heard in Paris in June, and judgment given on 10th inst. in favour of the Anglo Company, with costs to date. By this judgment the damages are to be assessed by experts, and are limited to the period between December 31st, 1886, and May 21st, 1891, the date on which the French Minister declared that the French company's concession would be forfeited if it attempted to renew the contracts. The question of an appeal is under consideration.

## The Edison and Swan United Electric Light Company, Limited.

The directors report that, in accordance with the agreement entered into with the Swan United Electric Light Company, Limited, and unanimously approved by the extraordinary meetings recently held in conformity with the articles of association, the foreign business and assets of the Swan United Company have been taken over as from October 1st, 1893, and the accounts now presented include such business and assets, in addition to the British business of the Edison and Swan Company itself. After providing for the interest accrued upon the £100,000 debenture stock, there remains a balance of £31,025 3s. 3d. available for distribution on the share capital. The board propose out of this balance to pay a dividend on the "A" shares at the rate of 6 per cent. per annum. An interim dividend at the rate of 5 per cent. per annum having already been distributed in respect of the business of the first half-year ending December, 1893, a further payment, equal to 7 per cent. per annum, in respect of the second half of the financial year will be paid, the balance being carried to the reserve fund. The business of the company, thus united, has resulted in a credit balance of £34,400 3s. 3d.; of this £8,836 19s. was distributed on March 20th last, as an interim payment on the "A" shares. The directors recommend a further distribution of £12,371 14s. 7d. on the "A" shares, to be distributed in accordance with clause 87 of the articles of association. This, with £3,375 interest on debenture stock, will absorb £24,583 13s. 7d., leaving £9,816 9s. 8d., which the directors have carried to the reserve fund in accordance with clause 89 of the articles of association. The directors consider the result as satisfactory, and also that the volume of business has increased during the year, in the face of active opposition in the lamp business since the expiration of the key patent in November last. The diminution of the money value of the sales is entirely due to the serious reduction in the price of the lamp.

## Chili Telephone Company, Limited.

The report of the directors to March 31st, 1894, to be submitted to the shareholders at the annual general meeting to be held on July 31st, 1894, at Winchester House, states that the small addition to the tariff made towards the end of 1893 caused some subscribers to withdraw, but others have taken their places, so that the aggregate in all centres was 3,987 at the end of the year 1893-4, only 37 less than at the beginning of that year. By this increase of rates the revenue has been augmented, notwithstanding the smaller number of subscribers.

| | |
|---|---|
| The income for the year was ... ... ... | $504,188 |
| That of the former year ... ... ... ... | 448,661 |
| Increase in 1893-4 over 1892-3 ... ... | $55,527 |

The further depreciation in the sterling value of the currency in which the company is paid—from 18d. per $ in 1892-3 to about 14d. for the subsequent year—has deprived the company of all benefit from this increase of revenue. It has also increased the outgoings—many more dollars having to be given for the same services—hence the net income was:—

| | |
|---|---|
| For the year 1892-3 ... ... ... ... ... | $184,673 |
| " " 1893-4 ... ... ... ... ... | 179,652 |
| Decrease in dollars ... ... ... ... | $5,021 |

In sterling the diminution of net income is more marked, being:—

| | |
|---|---|
| At 18d. per $ in 1892-3 ... ... ... ... | £13,850 |
| And at 13 96d. per $ in 1893-4 ... ... ... | 10,448 |
| Decrease in net income ... ... ... | £3,402 |

From this net income of £10,448 the interest on debentures and other expenditure in London are deducted, amounting to £4,943, which varies little from the aggregate of similar items in the previous year. The loss by the reduction of exchange in the sterling value of the liquid assets and liabilities in Chili amounted to £1,979, being less by £1,616 than the corresponding item in the former year. The net profit of the whole business was—

| | |
|---|---|
| In 1892 3 ... ... ... ... ... ... | £5,393 |
| In 1893-4 ... ... ... ... ... ... | 3,528 |
| Diminution ... ... ... ... ... ... | £1,865 |

This net profit of £3,528 has been added to the reserve fund. The cash is not available for distribution, having been used for capital purposes, instead of raising that sum by the issue of further capital. The difficulty in raising the tariff has been greater than the board anticipated. The manager in Chili writes thus:—"The revenue has been affected by the general depression of business and poverty of the people. As it is impossible for any country to experience a long-continued and severe depreciation of its currency without each individual feeling more or less the evil effects, the inevitable consequence in the present case has been a general attempt to reduce expenses. It must be remembered that the greater number of the subscribers are Chilians, and with the exception of important business centres, such as Valparaiso and Iquique, the telephone is, more or less, a luxury; and to dispense with the annual charge which keeping it involves, has appeared to be one of the first economies practised." The board has, however, instructed the manager to make a further considerable addition to the tariff, at the risk of losing

some subscribers; for it must be better to do a small but fairly profitable business than a large unprofitable one. As full notice of changes must always be given, it is not likely that much benefit will accrue from this before the beginning of 1895. The board directs attention to the extract from the manager's report as to the expenditure on account of capital. The retiring director is the chairman, Colonel R. Raynsford Jackson, but continued indisposition has compelled him to intimate his preference not to be re-elected, and the board does not propose to fill the vacancy at present. This retirement is much to be regretted, especially the cause of it. The board had reckoned upon much benefit to the company from Colonel Jackson's general business abilities and long experience in telephone enterprise. The auditor, Mr. Thomas A. Welton, also retires, and offers himself for re-election.

*Extract from the Manager's Report, dated Santiago, May 18th, 1894.*

"The amount spent for the year on capital, $99,853, has, with the exception of one item of $4,800 (for completion of unfinished trunk line), been expended on the connecting-up of new subscribers.

| | |
|---|---|
| The capital outlay for 1892-3—was ... ... | $222,684 |
| " " 1893-4 ... ... ... | 99,853 |
| A reduction of ... ... ... | $122,831 |
| In gold, the expenditure at 18d.—the average rate for the year 1892-3—was ... ... ... | £16,701 |
| And for 1893-4, at 13·96d. ... ... ... ... | 5,834 |
| Representing a less expenditure by ... | £10,867 |

During the year 289 miles of wire have been run, representing the lines of 918 new subscribers. It may be thought that the lines of ceased subscribers could have been utilised to such an extent as to make so large a new mileage unnecessary; it must, however, be borne in mind that in Santiago and Valparaiso—where most of the ceased lines exist—the buildings are much further apart than is the case of the cities of Europe and the United States, and it follows that these dead-lines can only gradually be taken advantage of. It should also be noted that the increase of rates, which caused many of the subscribers to retire their telephones, did not begin to have effect till the beginning of the last quarter of the year. It will be seen that the net increase of revenue represents a return of 52 per cent. on capital outlay, which is satisfactory, in view of the increasing cost of installation, without a corresponding increase in prices. It is, however, in the relation which the gross revenue bears to the cost of construction that the most satisfactory evidence is found to justify the outlay. A sum of $179,188 of new revenue has been created, giving a return of 180 per cent. on the outlay. It has already been shown that, except for causes due to the special circumstances of last year, a larger increase of net revenue would have resulted from the capital outlay than was actually the case. In drawing this inference, allowance has been made for increase of revenue caused by raising the rates, and also of the use which has been made of ceased subscribers' instruments and lines. In the current year the work will continue to be strictly limited to the bringing in of new subscribers, and every advantage will be taken of existing material, so as to avoid the cost of ordering material from England."

## The National Telephone Company.

THE annual meeting of this company was held on Wednesday at Cannon Street Hotel, Mr. J. Staats Forbes presiding.

In moving the adoption of the report, the CHAIRMAN pointed out that the accounts were made up to June 30th last, and therefore covered 14 months. The object of this was to make the two meetings which it had been decided to hold each year fit in with the calendar year. For the purpose of comparing the progress they had made in the 12 months ended April 30th, 1894, with the previous year, an abstract of accounts had been prepared, which showed that the income accrued in respect of the business of the year was £682,950, against £583,590 in the corresponding period of the previous year, while the working expenses and other charges, excluding debenture interest, had risen from £311,644 in the 12 months ended April 30th, 1893, to £344,168 in the 12 months ended April 30th, 1894, leaving a balance of £338,781, against £271,945. They had, however, to pay the Post Office 10 per cent. on all the gross receipts arising from what was called exchange business, which for the past year represented a sum equal to 2½ per cent. on the ordinary shares, or £63,254. Deducting this amount from the £338,781, it brought the net result for the year, which they could appropriate to their own purposes, to £275,526, as compared with £217,725 in the preceding 12 months. Out of the available balance, after paying the final dividends recommended in the report, the board proposed to transfer £63,429 to the reserve fund, so as to bring it up to £225,000, and to carry forward £1,765. Referring to the capital account, he remarked that every additional subscriber necessitated an outlay of about £42, and consequently their capital expenditure, owing to the nature of their business must continue to grow. It was satisfactory to find, however, that the capital outlay during the past 14 months had proved to be remunerative. After referring to the arrangements which had been carried out for the redemption of the £1,000,000 of 4½ per cent. debenture stock of the company, by its conversion into a 3½ per cent. debenture stock, he explained the negotiations with the Post Office in relation to the acquisition of the trunk lines of the company, and added that as all difficulties in the matter had now been practically overcome, the agreement would shortly be submitted for confirmation to the House of Commons, and he did not anticipate any serious objection being raised to it. In conclusion, he moved the adoption of the report.

LORD BALFOUR OF BURLEIGH, who seconded the resolution, referred to the complexity and difficulties of the problems to be faced in giving an efficient service to London.

Mr. GALBRAITH asked what the chairman had to say in reply to the letter written by the Postmaster-General to Mr. Henniker Heaton, M.P., dated the 6th inst., in which Mr. Arnold Morley said: "On the termination of the licence in December, 1911, the right of the National Telephone Company to carry on the telephone exchange business will cease. All they will have to sell will be their plant, and even this the Government will be under no obligation to buy."

The CHAIRMAN said that literally the statements contained in the letter were true, but there were some truths which were a good deal qualified by considerations and circumstances. "All they will have to sell will be their plant" was not true in fact. Mr. Arnold Morley when he wrote the letter no doubt believed it was, but he had not considered the fact that a large portion of their business consisted of private wire business. This was a growing quantity, and if they knew their business and played their game properly, it would be a hard nut for the Post Office of the day to crack. At the expiration of their lease this business might, perhaps, be worth £200,000 a year, and that would be something to sell. But long before that the Government would have to make up their mind whether they would take over the exchange business or not. Would they, in that case, six or ten years before the moment arrived, embark upon the enormous expenditure necessary to erect the requisite machinery and plant to supersede that already in existence in order to knock down the value of the company's business? The idea was so reckless that no one could imagine it being entertained by any responsible person. In these circumstances he thought the proprietors would do well to discount the words of Mr. Arnold Morley's letter.

Replying to a question as to the advisability of investing the reserve fund in consols, the CHAIRMAN said the board had advanced a step in that direction, and now that they could raise money at 3½ per cent. instead of 4½ per cent., the difficulty previously felt in the matter had to some extent vanished.

After further discussion the report was carried unanimously.

## Waterloo and City Railway Company.

THE report states that the prospectus which was issued by the directors pursuant to the authority given to them by the shareholders at their meeting on February 22nd last resulted in applications for shares of the company in excess of the number available for issue. An official quotation has been obtained from the Stock Exchange. The agreement between the company and the London and South-Western Railway Company, which was sanctioned by the shareholders in February last, has received the approval of the Railway Commissioners, and the Board of Trade have given the necessary certificate for the payment of interest on capital during the construction of the railway, in accordance with the Company's Act of 1893. The contract for the construction of the railway from the Mansion House to Cross Street, Waterloo Station, has been let to responsible contractors, who commenced operations on June 18th last. The terminal stations in the City and at Waterloo will form the subject of separate contracts. Following the example of most of the principal railway companies, the directors recommend the shareholders to adopt the provisions of the Forged Transfers Acts of 1891 and 1892, and declare the indefeasibility of the company's share certificates without any charge being made to the registered holders thereof. A resolution on this subject will be submitted to the meeting.

**The Gülcher (New) Electric Light and Power Company, Limited** (In Liquidation).—Notice is given that an extraordinary general meeting of the above-named company will be held at 73, Lombard Street, in the City of London, on Wednesday, the first day of August, 1894, at 11 o'clock in the forenoon, under the provisions of section 161 of the Companies' Act, 1862, for the purpose of considering and, if thought fit, passing the subjoined resolution:—"That Mr. Charles Fitch Kemp, the liquidator, be authorised to enter into an agreement with Easton, Anderson & Goolden, Limited, for the sale to that company of this company's plant, machinery, and stock-in-trade at the price of £12,500, payable as to £5,700, part thereof, in cash, and as to £6,800, the balance thereof, in 680 shares of £10 each, fully paid up in Easton, Anderson & Goolden, Limited." Should the foregoing resolution be passed by the requisite majority, it will be submitted for confirmation as a special resolution to a second extraordinary meeting, which will be subsequently convened.

**The Westminster Electric Supply.**—The board have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ending June 30th last, payable September 1st next.

## TRAFFIC RECEIPTS.

**The City and South London Railway Company.** The receipts for the week ending July 22nd, 1894, amounted to £839; week ending July 23rd, 1893, £764; increase, £75; total receipts for half-year, 1894, £2,600; corresponding period, 1893, £2,609; decrease, £9.

**The Western and Brazilian Telegraph Company, Limited.** The receipts for the week ending July 20th, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,238.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present issue. | NAME. | Stock or Share. ‡ | Dividends for the last three years. 1891. | 1892. | 1893. | Closing Quotation, July 18th. | Closing Quotation, July 25th. | Business done during week ended July 25th, 1894. Highest. | Lowest. |
|---|---|---|---|---|---|---|---|---|---|
| 184,500£ | African Direct Teleg., Ltd., 4 % Deb. ... ... ... | 100 | ... | ... | ... | 101 —104 | 101 —104 | ... | ... |
| 1,134,640£ | Anglo-American Teleg., Ltd. ... ... ... ... ... | Stock | £2 12s. | £2 15s. | £2 11s. | 37 — 40 | 37 — 40 | 40 | 39½ |
| 2,932,680£ | Do. do. 6 % Pref. ... ... ... ... ... | Stock | £5 5s | £5 10s. | £5 2s. | 71 — 73 | 71 — 73 | 73 | 71½ |
| 2,932,680£ | Do. do. Defd. ... ... ... ... ... ... | Stock | ... | ... | ... | 6½ — 7 | 6½ — 7 | 6⅝ | ... |
| 130,000 | Brazilian Submarine Teleg., Ltd. ... ... ... ... | 10 | 8 % § | 6½ % § | 6½ % § | 12 — 12½ | 12 — 12½ | 12⅝ | 12½ |
| 18,700£ | Do. do. 5 % Bonds ... ... ... ... | 100 | ... | ... | ... | 101 —104 | 101 —104 | ... | ... |
| 75,000£ | Do. do. 5 %, repayable June 1906 ... ... | 100 | ... | ... | ... | 107 —111 | 107 —111 | ... | ... |
| 44,000 | Chili Telep., Ltd., Nos. 1 to 40,000 ... ... ... ... | 5 | ... § | 10% ‖ § | ... § | 1 — 2 | 1 — 2 | ... | ... |
| 10,000,000$ | Commercial Cable Co. ... ... ... ... ... | $100 | 7 % | 7 % | 7 % | 139 —143 | 139 —143 | ... | ... |
| 224,850 | Consolidated Telep. Const. and Main., Ltd. ... ... | 10/- | 3½ % § | 2 % § | 2 % § | ¼ — ¼ | ¼ — ¼ | ¼ | ... |
| 16,000 | Cuba Teleg., Ltd. ... ... ... ... ... ... | 10 | 8 % | 8 % | 8 % | 12 — 13 | 12½ — 13½ | ... | ... |
| 6,000 | Do. 10 % Pref. ... ... ... ... ... | 10 | 10 % | 10 % | 10 % | 19 — 20 | 19½ — 20½ | ... | ... |
| 12,931 | Direct Spanish Teleg., Ltd., £4 paid ... ... ... | 5 | 4½% | 4 % | 4 % | 4 — 4½ | 4 — 4½ | ... | ... |
| 6,000 | Do. do. 10 % Pref. ... ... ... ... | 5 | 10 % | 10 % | 10 % | 9¼ — 9¾ | 9¼ — 9¾ | 9½ | ... |
| 30,000£ | Do. do. 4½ % Debs of £50, Nos. 1 to 1,600 | ... | ... | ... | ... | 103 —106% | 103 —106 | ... | ... |
| 60,710 | Direct United States Cable, Ltd., 1877 ... ... ... | 20 | 3½% § | 3½% § | ... | 8½ — 9½ | 8½ — 9½ | 9 5/16 | 8¾ |
| 400,000 | Eastern Teleg., Ltd., Nos. 1 to 400,000 ... ... ... | 10 | 6½ % § | 6½ % § | ... | 15⅝ — 15⅞ | 15⅝ — 15⅞ | 15⅞ | 15⅝ |
| 70,000 | Do. 6 % Pref. ... ... ... ... ... | 10 | 6 % § | 6 % § | ... | 16¼ — 16¾ | 16¼ — 16¾ | 16½ | ... |
| 105,900£ | Do. 5 % Debs., repay. August, 1899 ... ... | 100 | ... | ... | ... | 107 —110 | 108 —111 | ... | ... |
| 1,294,100£ | Do. 4 % Mort. Deb. ... ... ... ... ... | Stock | ... | ... | ... | 115 —118 | 115 —118 | 117 | ... |
| 250,000 | Eastern Extension, Australasia and China Teleg., Ltd. ... | 10 | 7 % | 7 % | 7 % | 15⅝ — 15⅝xd | 15⅝ — 15⅞ | 15¾ | 15 9/16 |
| 62,700£ | { Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326 } | 100 | ... | ... | ... | 103 —106 | 103 —106 | ... | ... |
| 222,800£ | Do. do. Bearer, 1,050—3,975 and 4,327—6,400 | 100 | ... | ... | ... | 103 —106 | 103 —106 | ... | ... |
| 320,000£ | Do. 4 % Deb. Stock ... ... ... ... ... | Stock | ... | ... | ... | 115 —119 | 116 —119 | ... | ... |
| 95,100£ | { Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343 } | 100 | ... | ... | ... | 103 —106 | 103 —106 | ... | ... |
| 129,100£ | Do. do. do. to bearer, 2,344 to 5,500 | ... | ... | ... | ... | 103 —106 | 103 —106 | ... | ... |
| 300,000£ | Do. 4 % Mort. Debs. Nos. 1 to 2,016, red. 1909 | 100 | ... | ... | ... | 105 —108 | 105 —108 | ... | ... |
| 200,000£ | Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,000 | 25 | ... | ... | ... | 107 —110% | 107 —110% | ... | ... |
| 180,227 | Globe Telegraph and Trust, Ltd. ... ... ... ... | 10 | 5½% § | 4½% § | 4⅝% § | 8⅜ — 8⅝ | 8½ — 8½ | 8 9/16 | 8½ |
| 180,042 | Do. do. 6 % Pref. ... ... ... | 10 | 6 % § | 6 % § | 6 % § | 15⅜ — 15½ | 15½ — 15½ | 15 9/16 | 15 7/16 |
| 150,000 | Great Northern Teleg. Company of Copenhagen ... ... | 10 | 8⅜% § | 8⅜% § | 8⅜% | 20¼ — 21 | 20¼ — 20½ | 20⅝ | 20 7/16 |
| 200,000£ | Do. do. do. 5 % Debs. | 100 | ... | ... | ... | 105 —108 | 105 —108 | ... | ... |
| 17,000 | Indo-European Teleg., Ltd. ... ... ... ... | 25 | 10 % | 10 % | 10 % | 44 — 46 | 44 — 46 | 45½ | ... |
| 37,548 | London Platino-Brazilian Teleg., Ltd. ... ... ... | 10 | ... | ... | ... | 5 — 7 | 5 — 7 | ... | ... |
| 100,000£ | Do. do. 6 % Debs. ... ... | 100 | ... | ... | ... | 107 —110 | 108 —111 | 108½ | ... |
| 15,000 | Monte Video Teleph. Co., Ord., 1 to 15,000 ... ... | 5 | ... | ... | ... | ½ — 1½ | ½ — 1½ | ... | ... |
| 28,000 | Do. do. 6 % Pref., 1 to 28,000 ... ... | 5 | ... | ... | ... | 1 — 2 | 1 — 2 | ... | ... |
| 484,597 | National Teleph., Ltd., 1 to 438,984 ... ... ... ... | 5 | 6 % § | 5 % § | ... | 4⅜ — 5 | 4⅝ — 5⅛ | 5 1/16 | 4⅞ |
| 15,000 | Do. 6 % Cum. 1st Pref. ... ... ... | 10 | ... | ... | ... | 14½ — 15½ | 14½ — 15½ | 15 | ... |
| 15,000 | Do. 6 % Cum. 2nd Pref. ... ... | 10 | ... | ... | ... | 14 — 15 | 14 — 15 | 14 13/16 | 14⅝ |
| 119,234 | Do. 5 % Non-cum. 3rd Pref., 1 to 90,950 | 5 | ... | ... | ... | 5⅛ — 5⅜ | 5⅛ — 5⅜ | 5 1/16 | 5⅛ |
| 925,017£ | Do. 4½ % Deb. Stock Prov. Certs. ... | ... | ... | ... | ... | 109 —112 | 109 —112 | ... | ... |
| 48,800 | New Teleph., Ltd., 25,901 to 74,700; £4 paid ... ... | 10 | ... | ... | ... | ... ... | ... ... | ... | ... |
| 171,504 | Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid | 1 | ... | ... | ... | 1/32 — 3/32 | 1/32 — 3/32 | ... | ... |
| 100,000£ | Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000 | 100 | ... | ... | ... | 101 —104 | 101 —104 | 103½ | ... |
| 11,839 | Reuter's Ltd. ... ... ... ... ... ... ... | 8 | 5 % | 5 % | ... | 5 — 6 | 5 — 6 | ... | ... |
| 3,381 | Submarine Cables Trust ... ... ... ... ... | Cert. | ... | ... | ... | 108 —113 | 110 —115 | 110½ | ... |
| 58,000 | United River Plate Teleph., Ltd. ... ... ... ... | 5 | ... | ... | ... | 1 — 2 | 1 — 2 | ... | ... |
| 146,370£ | Do. do. 5 % Debs. ... ... ... | Stock | ... | ... | ... | 90 —100 | 90 —100 | ... | ... |
| 15,609 | West African Teleg., Ltd., 7,501 to 23,109 ... ... ... | 10 | 4 % | .. | ... | 3 — 5 | 3 — 5 | ... | ... |
| 249,900£ | Do. do. do. 5 % Debs. ... ... ... | 100 | ... | ... | ... | 102 —105 | 102 —105 | 104⅜ | 104½ |
| 30,000 | West Coast of America Teleg., Ltd. ... ... ... ... | 10 | ... | ... | ... | 2½ — 3 | 2½ — 3 | ... | ... |
| 150,000£ | Do. do. do. 8 % Debs., repay. 1902 | 100 | ... | ... | ... | 96 —101 | 96 —101 | 100 | 99½ |
| 64,242 | Western and Brazilian Teleg., Ltd. ... ... ... ... | 15 | 4 % | 2½% | 5 % | 6¾ — 7¼ | 6½ — 7¼ | 6⅞ | ... |
| 33,129 | Do. do. do. 5 % Cum. Pref. ... | 7½ | ... | ... | ... | 5¾ — 6¼ | 5¾ — 6¼ | 6 | ... |
| 33,129 | Do. do. do. 5 % Def. ... ... | 7½ | 3 % | ... | ... | 1¾ — 2¼ | 1¾ — 2¼ | ... | ... |
| 178,200£ | Do. do. do. 6 % Debs. "A," 1910 ... | 100 | ... | ... | ... | 107 —110 | 108 —111 | 110 | ... |
| 222,700£ | Do. 6 % Mort. Debs., series "B," red. Feb. 1910 | 100 | ... | ... | ... | 107 —110 | 108 —111 | ... | ... |
| 88,321 | West India and Panama Teleg., Ltd. ... ... ... | 10 | ¼% | ¼% | ⅜% | 1 — 1¼ | 1 — 1¼ | ... | ... |
| 34,563 | Do. do. do. 6 % 1st Pref. ... | 10 | ... | ... | ... | 10 — 10½ | 10 — 10½ | 10⅜ | 10⅛ |
| 4,669 | Do. do. do. 6 % 2nd Pref. ... | 10 | ... | ... | ... | 9 — 10 | 9 — 10 | ... | ... |
| 80,000£ | Do. do. 5 % Debs. (1917) No. 1 to 1,000 | 100 | ... | ... | ... | 107 —110 | 107 —110 | ... | ... |
| $1,214,000 | Western Union of U. S. Teleg., 7 % 1st Mort. Bonds ... | $1000 | ... | ... | ... | 115 —120 | 115 —120 | ... | ... |
| 169,000£ | Do. do. 6 % Ster. Bonds. ... ... | 100 | ... | ... | ... | 100 —104 | 100 —104 | ... | ... |

## ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20,510 | { Charing Cross and Strand Electy. Supply, 1 to 6, 215 to 718, and 10,001 to 30,000 } | 5 | ... | 5 % | 4½% | 4½ — 5½ | 4½ — 5½ | ... | ... |
| 40,000 | City of London Elec. Lightg. Co., Ltd., Ord. 40,001—80,000 | 10 | ... | ... | ... | 12½ — 13 | 12½ — 13 | 13¼ | ... |
| 40,000 | Do. do. 6 % Cum. Pref., 1 to 40,000 | 10 | ... | 6 % | 6 % | 14 — 14½xd | 14 — 14½ | 14⅝ | 14¼ |
| 100,000 | Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid | ... | ... | ... | ... | 128 —130 | 128 —130 | 129½ | 129 |
| 45,000 | †Liverpool Electric Supply, £4 10s. paid ... ... ... | 5 | 4½% | 5 % | 5 % | 6½ — 6⅝ | 6⅝ — 6½ | ... | ... |
| 49,900 | *Metropolitan Electric Supply, Ltd., 6,101 to 50,000 ... | 10 | 1 % | 2 % | 2½% | 8¼ — 8⅜ | 8½ — 9 | 8½ | ... |
| 100,000£ | Do. 5% Deb., 1 to 10,000 in bonds of £10, £20, £40 | ... | ... | ... | ... | 106 —109 | 109 — 112 | ... | ... |
| 6,452 | Notting Hill Electric Lightg. Co., Ltd. ... ... ... | 10 | ... | ... | ... | 4½ — 5½ | 4½ — 5½ | ... | ... |
| 19,980 | St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-18,780 | 5 | 8½% | 7½% | 4½% | 7 — 7½ | 7 — 7½ | ... | ... |
| 20,000 | Do. do. 7 % Pref., 20,081 to 40,080 | 5 | 7 % | 7 % | 7 % | 8½ — 9 | 8½ — 9 | ... | ... |
| 59,900 | *Westminster Electric Supply Corp., Ord., 101 to 60,000 ... | 5 | ... | 3½% | 4 % | 6¼ — 6⅜ | 6¼ — 6⅜ | ... | ... |

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

## SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

### ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

| Present Issue. | NAME. | Stock or Share. ‡ | Dividends for the last three years. 1891. | 1892. | 1893. | Closing Quotation, July 18th. | Closing Quotation, July 25th. | Business done during week ended July 25th, 1894. Highest. | Lowest. |
|---|---|---|---|---|---|---|---|---|---|
| 90,000 | Brush Elecl. Enging. Co., Ord., 1 to 90,000 ... ... ... | 3 | ... | 6 % § | 6 % § | 2⅞— 3 | 2⅞— 3 | 2⅝ | ... |
| 90,000 | Do. do. Non-cum. 6 % Pref., 1 to 90,000 | 2 | ... | 6 % § | 6 % § | 2¼— 2½ | 2¼— 2½ | 2⅝ | 2⅛ |
| 125,000£ | Do. do. 4½ % Deb. ... ... ... | Stock | ... | ... | ... | 110 —113 | 110 —113 | ... | ... |
| 630,000£ | City and South London Railway ... ... ... ... | Stock | ... | ⅝% | ⅝% | 36 — 38 | 36 — 38 | ... | ... |
| 20,000 | Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 20,000 | 5 | 7 % § | 7 % § | 7 % § | 2½— 3 | 2½— 3 | ... | ... |
| 50,000£ | Do. do. 5 % 1st Mort. Debs., 1—400 of £100, and "A" 1—200 of £50 each | ... | ... | ... | ... | 95 —100 | 95 —100 | ... | ... |
| 120,000 | Electric Construction, Ltd., 1 to 120,000 ... ... ... | 2 | ... | ... | ... | ¼— ⅜ | ¼— ⅜ | ... | ... |
| 12,845 | Do. do. 7 % Cum. Pref., 1 to 12,845 ... | 2 | ... | ... | ... | 1½— 1¾ | 1½— 1¾ | ... | ... |
| 100,000 | Elmore's French Patent Cop. Deposg., Ltd, 1 to 66,750 ... | 2 | *nil* | *nil* | *nil* | ¼— ⅜ | ¼— ⅜ | ... | ... |
| 91,195 | Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000 ... ... | 2 | *nil* ¶ | *nil* | *nil* | 1⅛— 1⅜ | 1 — 1⅛ | ... | ... |
| 67,385 | Elmore's Wire Mfg., Ltd., 1 to 67,385, issued at 1 pm. ... | 2 | *nil* | *nil* | *nil* | ¾— 1⅛ | ⅝— 1 | ... | ... |
| 20,000 | Fowler-Waring Cables, Nos. 301 to 20,300 ... ... ... | 5 | *nil* § | *nil* § | *nil* § | ½— 1½ | ½— 1½ | ... | ... |
| 9,600£ | Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ... | 10 | 7 % | ... | ... | 6½— 7½ | 6½— 7½ | ... | ... |
| 6,837 | Henley's (W. T.) Telegraph Works, Ltd., Ord. ... ... | 10 | 5 % | 5 % | 5 % | 6½— 7½ | 7 — 8 | ... | ... |
| 50,000 | India-Rubber, Gutta Percha and Teleg. Works, Ltd. ... | 10 | 12½% | 12½% | 12½% | 23 — 24 xd | 23 — 24 | 25⅜ | 23⅜ |
| 200,000 | Do. do. do. 4½ % Deb., 1896 | 100 | ... | ... | ... | 103 —105 | 103 —105 | ... | ... |
| 37,500 | †Liverpool Overhead Railway, Ord. ... ... ... ... | 10 | ... | ... | 1 % | 8¼ — 8½ | 8 3/16— 8 5/16 | ... | ... |
| 6,295 | † Do. do. Pref., £8 paid ... ... | 10 | ... | ... | ... | 12⅝— 13⅜ | 12¾— 13⅜ | ... | ... |
| 78,949 | Swan United Electric Light, Ltd., £3½ paid ... ... | 5 | 11 % § | 10 % § | 7½% § | ... — ... | 2⅛— 2⅜ | ... | ... |
| 37,250 | Telegraph Constn. and Maintce., Ltd. ... ... ... | 12 | 20 % | 15 % | 20 % | 40 — 42 | 40 — 42 | 41¼ | 40½ |
| 150,000£ | Do. do. do. 5 % Bonds, red. 1894 | 100 | ... | ... | ... | 102 —105 | 102—105 | ... | ... |
| 54,000 | Waterloo and City Railway, Nos. 1 to 54,000, £2 paid ... | 10 | ... | ... | ... | 2 — 2¼ | ... ... | ... | ... |

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.

Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

CROMPTON & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%§; 1891—7%§; 1890—8%§.

### LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Birmingham Electric Supply Company, Ordinary of £5 (fully paid), 5¼—5⅜.

Electric Construction Corporation, 6 % Debentures, 87—92.

Electric and General Investment, shares of £5 (£1 paid), 1¾—2¼.

Electricity Supply Corporation, Ordinary of £5, 5—5¼.

House-to-House Company (£5 paid), 1—1½.

Do. do. 7 % Preference, of £5, 5¼—5½.

Do. do. 6 % Debentures of £100, 101—103.

Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid) 4¾—5¼; 1st Preference Cumulative 6 %, £5 (fully paid), 6¼—6⅜.

Liverpool Electric Supply, £5 (fully paid), 6¼—6⅜.

Do. do. £3 10s. paid, 4¼—4⅜.

London Electric Supply Corporation, £5 Ordinary, ⅞—1⅛.

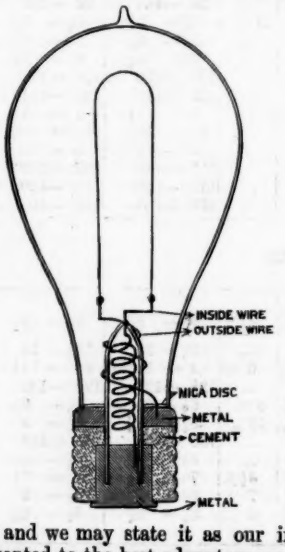
Queen Anne's Mansions Lighting and Heating Company, 6 % £100 Debentures, 101—103.

Yorkshire House-to-House Electricity Company, £5 Ordinary Shares (£4 10s. paid), 4¼—4⅜.

Bank rate of discount, 2 per cent. (February 22nd, 1894).

## THE FORREST INCANDESCENT LAMP.

A DR. W. E. FORREST, of New York, has been exercising his ingenuity in devising a new method of constructing incandescent lamps. It is claimed as a result of this gentleman's labours that not only is the Edison patent not infringed, but the modified lamp can be manufactured, labour, material and all, for 5¼d. The accompanying sketch




shows the idea, and we may state it as our impression that the lamp is presented to the best advantage on paper.

The mount and seal constitute the novelty in this as in almost all other modified lamps that have been proposed. A piece of glass tubing, 1 inch in length, contracted at one end but open at both, has a spiral steel spring inserted, and the lower end is then closed by immersing it into a brass cap filled with molten metal. The nature of the metal is, of course, not specified, but it is stated to have the same coefficient of expansion and contraction as glass. A second spiral steel wire is then placed on the outside of the tube and forms the other terminal to which the filament is joined. The length of the respective steel wires is 6 inches, this considerable length being used to prevent the heating of the metal seal from conduction from the filament mounts. A mica disc is placed half way down the tube, the lower end of the outside steel wire passing through a small hole in it. When the filament has been attached to the steel terminals—not, by the way, such a simple operation as with a softer metal—the mount is inserted into the neck of the bulb, the neck is heated, and a layer of molten metal is poured in on to the mica disc, thus sealing the whole arrangement. The rest of the neck of the bulb is then filled up with a fused, elastic, non-conducting cement which forms an additional seal to the lamp. Electric communication is made with the respective metal parts.

The arguments used to convince the reader of the merits of this method of construction are amusing. The materials are stated to cost as follows :—

| | |
|---|---|
| Bulb ... ... ... ... ... ... | 2·7 cents. |
| Filament ... ... ... ... ... | 1· „ |
| Mount ... ... ... ... ... ... | 0·11 „ |
| Metal ... ... ... ... ... ... | 0·5 „ |
| Wires and disc ... ... ... ... ... | 0·01 „ |
| Socket cap ... ... ... ... ... | 0·70 „ |
| Thimble ... ... ... ... ... ... | 0·10 „ |
| Cement ... ... ... ... ... ... | 0·01 „ |
| Total = | 5·13 cents. |

Then, since little or no skilled and but little hand labour is required in the manufacture of the lamp, it is within

bounds to put the total cost at 10½ cents. The lamp is said to be equal in beauty, candle-power, and life to any on the market.

It is almost needless to criticise seriously. The cost of the materials given, although incomplete and probably understated in some respects, is not so much to be found fault with as the labour. The materials employed in the ordinary lamp, including the fraction of an inch of platinum wire that is now customarily used, come to about this amount or a shade more. The skilled labour of the lad who seals the wires into a bulb (and which Dr. Forrest is at such pains to avoid) costs in one factory we are acquainted with, one-third of a penny. As regards the labour of constructing the customary simple wire mount and the arrangement shown in the sketch, there can be no two opinions. The inventor deserves some credit if he has succeeded in making lamps on this principle sound as regards vacuum, but we fear that we can afford him very little on any other point except that of ingenuity. Multiple parts and operations to effect a certain end are always to be avoided when possible, and the inventor would do well to try and simplify his lamps a little more before fitting up a factory to manufacture them, as it is asserted he is doing. In 30 days, as stated in the *Electrical Review* (New York), the new lamps are to be on the market, and the Lingro Incandescent Lamp Company has been formed to exploit the invention.

## THE NEW CALEDONIA—AUSTRALIA CABLE.

The *Bulletin* of the Société Internationale des Electriciens for June contains a paper on the above subject, communicated by Mr. A. Reynier, late engineer to the Société Générale des Téléphones.

There are not many sections of cable in existence which have attracted so much attention for various reasons, as this short length of about 800 miles at the Antipodes, and Mr. Reynier now tells us all about its history, construction, and laying, in a style so clear and with such detail, as to show that he is no stranger to the technicalities of the subject. The paper, indeed, is quite a model, and will be read over here with almost as much interest as across the channel.

The *raison d'être* of the cable is explained, and the conditions under which the landing rights and subsidies were obtained from the governments of New South Wales and Queensland are stated. These preliminaries having been settled in spite of considerable difficulties and opposition from powerful English companies, the French Government appointed a commission of 30 members to report on the matter, and their report being satisfactory, the government on March 23rd, 1893, made a definite contract with the Société Française des Télégraphes Sous-Marins for the construction and laying of the cable. A novel condition was that it was to be manufactured in France, and laid with a French staff in a French ship. France guaranteed a traffic of £8,000 a year for 30 years, while New South Wales and Queensland guarantee another £4,000 between them, making a total of £12,000 a year. The time given for the execution of the contract was six months. The Société Générale des Téléphones undertook to carry out this contract, and the manufacture of the cable was begun at Calais about the middle of April and completed early in June. The length made was over 800 miles, and the rigorous conditions of the Cahier des Charges imposed by the French Government were strictly complied with.

The embarkation of the 800 miles, together with 30 more as spare, was completed on June 17th, and the *François Arago* sailed on the following day for Australia *viâ* the Suez Canal and the Torres Straits.

While describing in detail the design of the types and general matters, Mr. Reynier pays a graceful tribute to the great pioneers of submarine telegraphy, Sir Charles Wheatstone, Sir Charles Bright, Lord Kelvin, Sir William Siemens, Sir Samuel Canning, and Messrs. Smith, Crampton, and Webb.

The staff of the *François Arago* consisted of Messrs. Rouilliard, Roussel, Fournier, and four other assistants—a number which Mr. Reynier, with reason, considers too small. These gentlemen had received their training under English engineers in the West Indies. Mr. Brylinski represented the French Government and Mr. Mirabel the French Company.

The *François Arago* arrived at Brisbane on August 16th. The shore end was landed at Gomen Bay, in New Caledonia, on August 30th, and the end buoyed. On September 11th, the soundings being completed and the route decided on, this end was spliced on to, and some 250 miles of cable laid towards, Australia, when the cable was cut and the end buoyed at a carefully selected spot with 1,000 fathoms of water. The ship then ran to Hervey Bay, in Australia, and on September 19th, the end of the cable having been landed near Mon Repos, started laying eastwards towards the buoyed New Caledonia end. Bad weather came on, and there was a heavy sea and strong wind, which had increased so much by the morning of the 22nd, when the buoy was sighted, that all hopes of successfully making the final splice was abandoned, and the cable was cut and buoyed. The weather did not moderate sufficiently until October 8th, when an attempt was made to raise the Australian end. The cable broke at a kink, and was lost. The end was raised, however, without difficulty on the next day, spliced to, and cable paid out to the Gomen end. This end unfortunately also broke at a kink when being raised, and it was not until October 15th that the final splice was made and the section completed. The deepest water encountered was 2,400 fathoms.

Tests after submersion on the whole length of 792½ miles gave a C.R. of 9·77 ohms legal, and an insulation resistance of about 9,000 megohms per mile at sea temperature, and were in every way satisfactory.

Mr. Reynier speaks in the warmest terms of the assistance given, and the courtesy displayed by the high officials of the Australian Government who accompanied the expedition, and particularly mentions the Hon. J. Kidd, the Hon. H. W. Wilson, the Hon. Audley Coote, and Messrs. P. B. Walker and J. McDonnell.

The first submarine cable made and laid by Frenchmen in a French ship was thus accomplished with perfect success, and we heartily wish our neighbours the same good fortune in the future.

The paper concludes with a tribute to the directors of the Société, Messrs. Vuigner and Wallerstein, who were directly responsible for the organisation of the expedition.

## CHLORIDE OF LEAD BATTERY.

By EMILE ANDREOLI.

It is inopportune to go thoroughly through the history of the chloride of lead battery. *Nomina sunt odiosa.* It was a great satisfaction to me to find that no one in France, in America, or in this country, contradicted me when I asserted that I was the first to invent, to construct, and to patent electrodes for accumulators made by means of a fused salt of lead in combination with a grid. This is the invention which I defended in 1889, when I successfully opposed the Laurent-Cély specification filed for the same object. How could I suppose that a little later another specification by the same applicant would be filed, and that a patent would be granted to him for the same so-called invention?

Having settled this question of the invention of a grid in combination with fused chloride of lead, which is worked by the Chloride Electrical Storage Syndicate, I will now briefly examine the mode of manufacture of the electrodes of the patent chloride electric accumulator.

"We melt," say the patentees, Laurent-Cély and Timmis, "chloride of lead (which anyone can do, as the melting of lead and other chlorides, see Maxwell Lyte expired patent, 1,363, 1882, is common property), and then we add as much as 25 per cent. of pure metallic zinc." . . . "This is," they add, "a most important and quite new invention."

I am sorry to disagree with them, but I am compelled to say that their new invention is not new at all, and that it is not an invention in the present case, as the fusion of chloride of lead in combination with metallic zinc was patented in Belgium on January 17th, 1886. The reduction of the chloride of lead and its transformation into litharge by the Laurent-Cély and Timmis process, are fully described in

the above-mentioned Belgian, and also in the Marchenay patents.

The casting of what is called by euphemism an antimonious lead framework (another name for a grid) belongs to J. S. Stevenson, who in 1887 had, according to *La Lumière Electrique*, constructed his electrodes by means of pastilles made of active material round which antimonious lead was cast. The elimination of the chlorine, which would prevent the peroxidation of lead, is common property, and I described it fully in my first patent; and as regards the transformation of porous lead into litharge under the oxidising action of hot air, it is ancient history.

Is it not ludicrous to see that the catalogue of the company who make such accumulators, bears the sonorous name of Patent Chloride Electric Accumulators, which reminds us of so many patent articles made by known processes.

There is no country where patents can be so easily obtained as in England; and when a patent has been granted, there is no country where it is more difficult to upset it. It is, indeed, a great disgrace that the English Patent Office, who has officials called Examiners, does not examine the patentability of each invention, or, at all events, the specifications of applicants who, have been once refused the Great Seal, because they were infringing the patent rights of a true inventor, and from whom they may have had cognisance of the invention.

I contend that if a man who has been defeated in a first attempt, applies a second time for a patent, and files a specification which, practically, is the same as the first which has been rejected by the Comptroller, the Patent Office ought to inform the real inventor who has proved in the first instance that his patent rights have been infringed, or that something still graver has been done.

I write this in the hope that in the future the Patent Office officials will understand that under some circumstances they have no right to grant a patent without the knowledge of the inventor who had already opposed an application of the infringer.

In fact, an infringer ought not to be allowed to apply twice for patenting the same process.

It may be that I appear to be like an agent who writes a report on the validity of a patent; let it be so, but my views are higher. What does public opinion call the writer who derives an income from the sale of a book which he has not written and the plot of which has been imagined by another one? What do painters and sculptors think of men who would sell as their work a picture or statue which was even partially copied from another artist? As they are applied, the rules of the Patent Office are tantamount to the sanction of the spoliation of a true inventor; a reform is necessary, and it is time that the duty of the Examiner will be really to examine the claims of any infringer to what he resolutely and unscrupulously calls his invention. A patent granted is more than nine points of the law; this is too much, and in too many cases it is outrageously iniquitous. The revenue of the Patent Office is large enough, the salaries of the Patent Office officials are big enough, to entitle the men who toil, work, suffer and pass through all the ordeals of the life of inventors, to expect protection and justice.

If this story of the patents of the Chloride Electrical Storage Syndicate excites any protest, I will go into fuller particulars, but nobody I am sure will reply, and silence will mean consent. *Sic vos non vobis.*

Partisans of the Planté or of the Faure accumulators may say what they like against the Chloride of Lead battery or affect to ignore its merits; there is not another one which may compete with it. Solidity, cheapness, durability efficiency, such are the advantages which a good secondary battery must possess.

The chloride of lead battery, or to be more precise, the battery made of fused lead salts in combination with a grid, possesses all these properties, and may be called the champion of all accumulators. It is a great pleasure for me to recognise the merits of the electrodes of the Chloride Electrical Storage Syndicate, and I fully endorse the statements they make in their catalogue.

The chloride plates are of a more homogeneous and perfect nature than anything hitherto offered to the public, and their reduced weight and smaller space occupied for a given output together with other advantages, place them greatly in advance of anything yet made. They combine the advantages of a perfect mechanical and electrical connection between the frame and the active material, and the formation of the latter by means which ensure absolute uniformity and maximum porosity. The weight for a given capacity is considerably less than that of the cells which are in general use at the present time. The great porosity and unique construction of the plates admit of the battery being discharged at very high rates; in fact, it can be discharged in one or two hours without detriment or risk of damage; the possible rate of charge is also very high, and a set of cells can be fully re-charged in three to four hours.

What a pity it is the mixture of chloride of lead and zinc is common property!

It is very regrettable indeed, also, to find that the reduction of porous lead, and its transformation into litharge is as old as the use of fused chloride of lead, which is common property.

Is it not still worse that the use of a grid, in combination with chloride of lead, has not been invented by those who sold their supposed patent to the Chloride Electrical Storage Syndicate, who, nevertheless, is bound to make a success of its Patent Accumulator?

## REVIEWS.

*The Steam Engine and other Heat Engines.* By J. A. Ewing, M.A., B.Sc., F.R.S., M.Inst.C.E. Cambridge: at the University Press, 1894.

There have been so many books on the steam engine that the appearance of a new one is apt to irritate. This latest comer, however, does not raise one's ire. It is a scholarly and good work, of great merit and singularly free from what we have come to look upon as the professional taint. The contents comprise chapters upon the early history of the steam engine, elementary theory of heat engines generally, the physics of steam and the theory of the steam engine particularly; the actual behaviour of steam in the cylinder; testing, compounding, valve gears, governing; the work on the crank shaft; boilers, forms of the steam engine; air, gas and oil engines. The author accepts the newer value of J, namely 778 for the mechanical equivalent of heat, as determined by Rowland and Griffith, and indicated by Joule himself in his later work.

The author has been particularly fortunate in his choice of the practical examples with which to illustrate the volume, and seems to have a happy facility in affording just such information as the student wants to possess, or the practical man wishes to have to refer to, and where further reference is likely to be needed footnotes are added, giving original sources. In the historical chapter there is reproduced at length Watt's note appended to the article "Steam engine" in Robinson's "System of Mechanical Philosophy." In this note Watt states that he perceived on reflection that it was necessary to maintain the cylinder always as hot as the steam that enters it. This was the thought that led Watt up to the independent condenser and air pump, and it is upon the living up to this thought that all steam engine economy depends. Our author emphasises this, and it lies at the bottom of what he has to say upon the behaviour of steam in the actual cylinder and on compound expansion. An instance of the general style and manner of the book is seen in the paragraph on steam jackets. It only fills two pages, but in those two pages is compressed the pith of the whole theory and practice of jacketting. Equally brief, yet equally clear, are the paragraphs on the influence of speed, size and ratio of expansion, with figures from practice in illustration on superheating and other details of practice. Though by no means a book for the designer of a steam engine in the narrow sense of mere material construction, there is a good chapter on valves and gears which will be useful to the designer, as also will that on governors.

Good and practical as are the chapters on the steam engine, that on boilers is equally remarkable as a statement of engineering fact as distinguished from mere pedantic assumptions. We should like to have had a little more space devoted to mechanical stokers and to liquid fuel. When a really luminous writer on the steam engine does write a book he ought to be a little more liberal upon the vexed and newer

problems. Prof. Ewing's language throughout is so good that it really seems as though we were going too far aside in finding fault with the use of the word "struggle" to describe the movement of steam in the Parsons turbine. Struggling seems to imply inefficiency, and this turbine appears too efficient in comparison with other steam engines for the word to be suitably applied. We like the author's remarks on furnace draught and feed water heaters, and on chimneys. We are much inclined to think that the height of a chimney is often made excessive. True a tall chimney better distributes smoke over a wide area without too severe concentration on any one spot, as for instance a neighbouring hill side, but too frequently a tall chimney is but a sufficiently capacious chimney drawn out until it has become of too small a cross-section. For most ordinary purposes, a height of 120 feet with a good cross-section, is ample. Lancashire practice, and that of the manufacturing districts generally, is, we know, to employ tall chimneys of 200 or 250 feet, but this practice has grown up very much as a corollary to the position of so many chimneys in deep valleys, or where they were liable, when short, to discharge too directly into their owner's drawing-room windows, or into the windows of some other men, who, not having any beneficial interest in the dirty fumes, were apt to make themselves disagreeable in the matter of injunctions. North Country practice is not, therefore, to be blindly followed in this matter, and we like to see a stout chimney, and one not too tall, unless it can be assured that the power of a tall chimney can be properly utilised, and not thrown away from the first by reducing its area at the top. Our author seems inclined to these same views, and, generally, may be described as a moderate man in all he has said.

Steam engineering is throughout so much a matter of compromise that novel ideas and novel methods are very apt to hold good over quite a small range of conditions, and in regard to quadruple expansion we are told that it only demands attention for pressures above 190 lbs., and is not therefore common. Probably no other book on the steam engine has had compressed between its two covers so much sound information in so readable a form. It should be in every student's hands.

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*Electrical Measurements for Amateurs.* By E. Trevert. Bubier Publishing Company, Lynn, Mass., America.

There is much that is good in this book, and it is an improvement over some of the writer's previous works. A misprint we notice occurs in a formula on page 59. On page 68 it is stated that insulators can be tested by placing them in a vessel of *mercury*. Mr. Trevert can hardly have had much experience of insulators, if he thinks they can be tested in anything else than water; how is mercury to penetrate a crack? Altogether we are well pleased with the book, which contains much useful information in comparatively few pages; we think, however, that it is a cut above amateurs.

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*The Development and Transmission of Power.* Unwin. The Howard Lectures. London: Longmans & Co.

We printed most of these lectures at considerable length during their delivery. This work contains considerably more than we had in the lectures and is a most important treatise of perhaps the most important subject the electrical and mechanical engineers of the present day have to deal with, and contains most valuable information on all the known methods and appliances for the development and transmission of power.

Water-power, and transmission, tele-dynamic transmission, rope transmission, compressed air and electric transmission, are all handled in a masterly manner and the latest developments clearly and simply explained.

The author makes out a good case for compressed air transmission and goes into details regarding the wonderfully successful compressed air plants in Paris. Traction by electricity and compressed air is treated carefully and the Niagara scheme for transmitting power is discussed.

The electrical engineer will find much in it of deep interest to him, and it will afford the necessary data to enable him to compare his methods and results with those of the hydraulic, pneumatic, gas, and mechanical engineer.

## NEW PATENTS—1894.

13,216. "Magnetic separator." W. H. Ryder and J. I. Ryder Dated July 9th.

13,259. "Improvements in automatic electric exchange." R. Pippette. Dated July 9th.

13,267. "Improvements in galvanometers." J. Hopkinson. Dated July 9th.

13,286. "Improvements in electrical apparatus for stopping horses." C. Pack. Dated July 9th.

13,293. "Improvements in gas and oil motor engines." S. Griffin. Dated July 10th.

13,319. Improvements in electric arc lamps." P. Kirkegaard. Dated July 10th. (*Complete.*)

13,331. "An electrically-controlled lubricating device." L. W. de Grave. Dated July 10th.

13,333. "Improvements in gas engines." G. C. Marks. (Communicated by F. Hirsch, United States. Dated July 10th. (*Complete*)

13,358. "Improvements relating to electrolysis, and to apparatus therefor." H. H. Lake. (Communicated by I. L. Roberts, United States.) Dated July 10th. (*Complete.*)

13,363. "An improved plate for secondary voltaic batteries." W. A. B. Buckland. Dated July 10th. (*Complete.*)

13,377. "Improvements in process and apparatus for electrolytically treating salts in solution or in molten state." P. Jensen. (Communicated by H. C. F. Störmer, Norway.) Dated July 10th. (*Complete.*)

13,381. "Improvements in or applicable to oil engines." H. Cook. Dated July 10th.

13,405. "Improvements in and relating to induction coils for medical purposes." A. Cheetham and F. Brown. Dated July 11th. (*Complete.*)

13,410. "Improvements in electrical switches." C. M. Dorman and R. A. Smith. Dated July 11th. (*Complete.*)

13,416. "Continuous electric brakes for railway trains." A. Young. Dated July 11th.

13,422. "Improvements in or connected with electric relays." W. P. Thompson. (Communicated by C. E. Maréchal, P. C. H. Rigollet, and The Société E. Ducretet & L. Lejeune, France.) Dated July 11th.

13,433. "Improvements relating to electric telegraphy." C. J. A. Munier. Dated July 11th.

13,478. "Electric arc hood." S. G. Brown. Dated July 12th.

13,499. "Improvements in process and apparatus for electrolytical decomposition of alkali salts." A. Sinding-Larsen. [Date applied for under Patents, &c., Act, 1883, Sec. 103, December 12th, 1893, being date of application in Norway.] Dated July 12th. (*Complete.*)

13,523. "Improvements connected with reflectors for electric arc lamps." C. Coerper. Dated July 12th. (*Complete.*)

13,524. "Improvements in gas engines." A. Vermersch. Dated July 12th. (*Complete.*)

13,549. "Improvements in apparatus for working electric tramways by means of underground cables." C. Anderson. Dated July 13th.

13,550. "Improvements in apparatus for working electric tramways." C. Anderson. Dated July 13th.

13,568. "An improved combined electric switch and regulator." F. Tallack, F. W. Tallack, and L. Hendle. Dated July 13th.

13,579. "Improvements in coin-controlled electrical apparatus." J. O. Frost. [Date applied for under Patents, &c., Act, 1883, Sec. 103, December 30th, 1893, being date of application in United States.] Dated July 13th. (*Complete.*)

13,581. "Improvements in electric cables." S. P. Thompson. [Date applied for under Patents, &c., Act, 1883, Sec. 103, December 19th, 1893, being date of application in United States.] Dated July 13th.

13,594. "Improvements relating to the insulation of wires for electric heating apparatus." H. Helberger. Dated July 13th.

13,623. "An invisible electric switch and bracket combination." T. E. Waltham. Dated July 14th.

13,634. "Improvements in arc lamps." J. W. Rogers. Dated July 14th.

13,636. "Improvements in perforators used for transmitting telegraphic messages and cablegrams." H. Whawell. Dated July 14th.

13,640. "Improved medico-electric pad or bandage." A. Owen. Dated July 14th. (*Complete.*)

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1893.

2,318. "Electric percussive tool." G. H. Williams. Dated February 2nd. The object of the invention is to construct a tool having a reciprocating plunger, actuated by an electric current, and adapted to take the place of the methods now employed in operating chisels, drills, and other analogous instruments. 9 claims.

3,528. "Improvements in or relating to armatures for dynamo-

electric machines, electric transformers, and the like." J. G. Statter. Dated March 28th. Consists in winding the primary coils in Gramme fashion and the secondary coils in Sturgeon or Siemens fashion (or *vice versâ*) upon the same core. 3 claims.

4,874. "Improvements in transforming, rectifying, and generating electric currents, and apparatus therefor." H. F. Foster. Dated March 7th. Consists in the combined application of both continuous and alternating currents to transformers. The inventor winds on the core of a suitably-designed transformer preferably three coils, two of which form the primary circuits and the third the secondary. One of the primary coils carries the continuous current, the other the alternating current. 3 claims.

5,198. "Improvements in and in making electrolytic apparatus." J. Hargreaves and T. Bird. Dated March 10th. Claims:—1. In electrolytic apparatus, the employment of a porous diaphragm consisting of fibrous material bound together by an insoluble silicate, obtained substantially as described. 2. For use in electrolytic apparatus the combined diaphragm and cathode formed substantially as herein described, and consisting of fibrous material deposited on wire gauze, the fibres being bound together by an insoluble silicate. 3. In the manufacture of a combined diaphragm and cathode for use in electrolytic apparatus, depositing the lime or its equivalent and the asbestos or other fibrous material on the wire gauze cathode, then drying the same, and finally steeping the cathode and dried pulp in a solution of silicate of soda or of potash, in order to convert the lime or its equivalent into an insoluble silicate.

6,551. "A process and appliance for electrically treating gaseous and other bodies, a new compound gas made by such process, and apparatus for producing and consuming said gaseous product." T. G. Hall. Dated March 28th. The principal purpose of this invention is to provide means and methods whereby compound bodies will be decomposed and the elements thereof, together with one or more other elements, recombined in a true chemical union induced by the electric, electro-chemical, catalytic, or other action obtaining in the presence of electric action or phenomena, such elements having hitherto been only mechanically united. 19 claims.

6,684. "Improvements in lighting and extinguishing attachments for gas, electric, and other lamps." H. L. Muller and W. Adkins. Dated March 30th. Consists essentially of chronometric mechanism, operating and connected with an adjustable dial wheel, a time wheel, and turning on and shutting off hands carried by the first-named wheel, an escape wheel turning on the same common axis as the time wheel, and which axis is driven by a pinion which takes its motion from the chronometric mechanism enclosed within a drum casing. 14 claims.

7,266. "Improvements in the distribution of electrical energy." J. Whitcher. Dated April 8th. Relates to a means of controlling the transformers in circuit, in order that some of these transformers may be magnetically put out of action during periods of light load. 8 claims.

7,713. "Improved gland joint for electrical conductors." W. C. Johnson. Dated April 15th. Claims:—1. In gland joints for electrical conductors, the combination of an internally tapered or trumpet mouthed gland with an elastic packing ring, through which the conductor is introduced, so as to form a tight joint by means of the compression of the ring between the conductor and the gland, substantially as described. 2. In a gland joint such as is referred to in the preceding claim, forming a circular groove at or near the inner end of the gland into which the elastic ring springs, so as to be held in position thereby, substantially as described.

8,316. "Improvements in the electrical propulsion of boats and vessels." A. G. New and A. J. Mayne. Dated April 25th. Relates to a motor designed of great height and length relative to its width, which is extremely narrow. 3 claims.

8,567. "Improvements in portable electric lamps." O. March. Dated April 28th. Claim:—1. A portable electric lamp and battery in one outer containing box or case having a shutter or shade so constructed that the opening of such shutter or shade completes the lamp circuit and the closing of such shutter or shade breaks the lamp circuit without the necessity of any separate appliance for effecting this purpose such portable electric lamp being constructed and arranged substantially in the manner described.

8,854. "Improvements in steam turbines and wheels." The Hon. C. A. Parsons. Dated May 3rd. Relates to a reaction engine consisting of one or more pairs of arms mounted upon a spindle and so arranged that steam is admitted to the interior of the said arms by suitable passages in the spindle and is discharged from each pair by apertures at the ends of the arms arranged to discharge at or near the tangent to the circle swept by the arms. 5 claims.

8,901. "Improvements in microphones." E. J. P. Mercadier and J. M. Anizan. Dated May 3rd. The inventors employ a vibrating plate of a homogeneous substance and of dimensions calculated so as to avoid the natural vibrations of the plate; they employ a plurality of carbon pencils; they have isochronism of the vibratory movements of all the pencils by using a single contact block or bar fixed at only one point of the vibrating plate and in its centre, and they improve the mobility of the pencils. 2 claims.

10,081. "Improvements in and relating to electromotors." W. Greenhalgh. Dated May 20th. Claims: 1. In an electromotor to be actuated either by continuous currents, of high or low pressure, or by alternating currents, the combination of a laminated iron field magnet and laminated iron armature of the shape substantially as described. 2. In an electromotor to be actuated either by continuous currents of high or low pressure, or by alternating currents, the use of an insulating material, such as plaster of Paris, as a means of supporting the armature in position, substantially as described. 3. In an electromotor to be actuated either by continuous currents of high or low pressure, or by alternating currents, the combination therewith of a governing device for regulating the speed of the motor, substantially as described.

10,304. "Improvements in lighting and extinguishing electric lamps for street lighting." J. Lobley. Dated May 24th. In one arrangement of apparatus according to this invention the arc lamp cable is passed through the automatic switch apparatus in series with the arc lamps, and whenever the arc lamp current is on the apparatus switches on the current from the general supply low pressure mains to the incandescent lamps arranged in parallel. 4 claims.

10,584. "Improvements in connection with electrolytic apparatus." H. Y. Castner. Dated May 30th. Consists in so mounting the electrolytic cells that they shall be capable of being rocked or tilted by mechanical means at regular intervals, the result being that the mercury or other material at the bottom of one compartment will be caused to flow to the compartment next in order, from whence it will be returned, after being subjected to suitable electric action therein. 3 claims.

10,993. "Improvements in electric search light apparatus." G. Sciama. Dated June 5th. The apparatus comprises the optical part or projector, the operative mechanism, the mechanism for distributing the electric current, and the lamp. 12 claims.

11,176. "Improvements in electric bell and like indicators." J. T. Gent, A. W. Staveley, and I. H. Parsons. Dated June 7th. The object of the invention is to simplify the construction of pendulum indicators, and to reduce the cost of manufacture. 1 claim.

11,973. "Improvements in apparatus for electrolysis of water." Siemens Bros. & Co., Ltd., and E. F. A. Obach. Dated June 17th. Relates to apparatus, of voltameter kind, for electrolytic decomposition of water in such a manner as to effect evolution and perfect separation of the oxygen and hydrogen uncontaminated by other matters. 1 claim.

12,458. "Improvements in dynamo-electric machines." M. Hutin and M. Leblanc. Dated June 24th. Claims:—1. In order to avoid the effects of self-induction in a generator, the use of a continuous current machine with its collector so arranged that in each section of the armature there is introduced an exterior circuit in which is to be consumed the whole or part of the energy rendered disposable in that section, the brushes applied to the conductor being closed on any circuit. 2. The combination of a like machine with a transformer analogous to those which we have devised as a transformer of frequency and tension. The transformer combined with the machine should be capable of utilising the energy furnished by as many currents of the same frequency but of as many distinct phases as there are different sections in the armature of the machine. All this energy will be communicated, as the case may be to 1, 2, 3, &c., currents of the same intensity and frequency, but regularly varied in phase. 3. The reversibility of the system above referred to and its application to the production of work at the expense of the energy furnished by one alternating current, two diphased, or three triphased currents.

13,774. "A means of maintaining the human body in electrical connection with the earth." E. Spratt. Dated July 15th. Claim:—The combination with a boot or shoe, or other foot covering, of an electrical conductor passing right through from the exterior to the interior of the foot covering, so that this conductor, while coming in contact with the earth on the exterior comes in contact with the foot—or with another conductor, such as a wire in the sock in contact with the foot—in the interior of the boot, thereby bringing the body of the wearer in direct electrical communication with the earth, substantially in the manner and for the purposes hereinbefore described.

14,469. "Improvements in electric arc lamps." A. W. Richardson. Dated July 27th. The main magnet or solenoid or main and shunt solenoid combined form the basis on which all the parts are attached. The magnet core is hollow and lined with brass in which the top or positive carbon is inserted. In the hollow core is placed a small weight which is hollowed out to receive the end of the top or positive carbon, this weight has one or more springs or bushes which rub against inside of liner tube in magnet core to make contact. On the top of magnet core is placed a dashpot, which moves with it, made in such a way that the fluid in same cannot be spilt in whatever position the lamp may be placed. The piston of dashpot is fixed to the top of magnet. On the bottom of magnet core is fixed the clutch which actuates the carbon rod. 7 claims.

14,756. "Improvements in dynamo-electric generators and motors." A. G. Brookes. (A communication from H. J. Ryan, of New York.) Dated August 1st. Consists in placing the opposing or counteracting conductors of the balancing coils in holes or openings entirely beneath the surfaces of the pole faces and cutting a very thin slot from these holes out to the pole faces. 6 claims.

15,479. "Improvements in electric arc lamps." L. E. Howard. Dated August 15th. Consists in surrounding the arc with a transparent or translucent heat-resisting envelope tightly closed at all points below the arc, and provided with means for permitting the egress of heated gases at the top, and making this envelope sufficiently small in size, so that the gases surrounding the arc may be maintained by the heat thereof in a luminous or incandescent condition. 16 claims.

16,019. "Improvements in metal posts or supports for electric wires or cables, also applicable for other purposes." O. Andre. Dated August 24th. The post is made up of four uprights of angle iron of any suitable section, arranged pyramidically. These angle irons are supported at distances apart by supporting frames of wood, corrugated sheet iron, or any other material, and metal hoops, which may be put on either hot or cold. 5 claims.